JPRS-CST-87-026
17 JUNE 1987

212022

FOREIGN BROADCAST INFORMATION SERVICE

JPRS Report

Science & Technology

China

SPECIAL NOTICE

Effective 1 June 1987 JPRS reports will have a new cover design and color, and some reports will have a different title and format. Some of the color changes may be implemented earlier if existing supplies of stock are depleted.

The new cover colors will be as follows:

CHINA.....aqua
EAST EUROPE.....gold
SOVIET UNION.....salmon
EAST ASIA.....yellow
NEAR EAST & SOUTH ASIA...blue
LATIN AMERICA.....pink
WEST EUROPE.....ivory
AFRICA (SUB-SAHARA).....tan
SCIENCE & TECHNOLOGY.....gray
WORLDWIDES.....pewter

The changes that are of interest to readers of this report are as follows:

All science and technology material will be found in the following SCIENCE & TECHNOLOGY series:

CHINA (CST)
CHINA/ENERGY (CEN)
EUROPE & LATIN AMERICA (ELS)
USSR: COMPUTERS (UCC)
USSR: EARTH SCIENCES (UES)
USSR: MATERIALS SCIENCE (UMS)
USSR: LIFE SCIENCES (ULS)
USSR: CHEMISTRY (UCH)
USSR: ELECTRONICS & ELECTRICAL ENGINEERING (UEE)
USSR: PHYSICS & MATHEMATICS (UPM)
USSR: SPACE (USP)
USSR: SPACE BIOLOGY & AEROSPACE MEDICINE (USB)
USSR: SCIENCE & TECHNOLOGY POLICY (UST)
USSR: ENGINEERING & EQUIPMENT (UEQ)

The USSR REPORT: MACHINE TOOLS AND METALWORKING EQUIPMENT (UMM) will no longer be published. Material formerly found in this report will appear in the SCIENCE & TECHNOLOGY/USSR: ENGINEERING & EQUIPMENT (UEQ) series.

If any subscription changes are desired, U.S. Government subscribers should notify their distribution contact point. Nongovernment subscribers should contact the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

JPRS-CST-87-026

17 JUNE 1987

SCIENCE & TECHNOLOGY

CHINA

CONTENTS

/12223

APPLYING EXPERT SYSTEM METHOD TO INTERPRETATION OF SEISMIC FACIES

Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese Vol 24 No 1, 1987 pp 4-7

[English abstract of article by Wang Shulin [3769 2885 2651], et al., of the Institute of Computing Technology, Chinese Academy of Sciences; Zhong Guosen [6988 0948 2773], et al., of the Ministry of Petroleum Industry]

[Text] The expert system SFAES introduced in this paper implements the interpretation of seismic facies in which human intelligence is involved. The system can recognize and analyze various reflection configurations. The results produced are consistent with the expectations of human experts. The authors utilize the ES method in developing this system, and the knowledge of interpretation can be added conveniently. A control method called blackboard architecture is used in this system. Practical experience has proved that the blackboard is a powerful means of solving some complex problems. The research on SFAES creates a favorable background for developing a knowledge processing system for interpretation of seismic data. (Paper received Jan 86.)

REFERENCES

[1] D. S. Nau, "Expert computer systems", Computer, Vol 16, No 2, 1983.
[2] M. Stefik, "The organization of expert systems, A Tutorial", Artificial Intelligence, Vol 18, 1982.
[3] Frederick Hayes-Roth, "The knowledge-based expert systems: A Tutorial", Computer, Vol 17, No 7,1984.
[4] L. D. Erman and V. R. Lesser, "A multi-level organization for problem-solving using many diverse cooperating sources of knowledge", Proc. 4th IJCAI, 1975, p483-490.
[5] Barbara Hayes-Roth, "A blackboard architecture for control", Artificial Intelligence, Vol 26, 1985.
[6] Report E. Sheriff, "Seismic stratigraphy".
[7] G. Mccalla, N. Cercone, "Approaches to knowledge respresentation", Computer, 1983, 10.
[8] Wang Shulin, "The remarks upon research of knowledge processing", 计算机研究与发展 Vol 21, No 5, 1984.
[9] Erman, L. D., Hayes-Roth, F., Less, V. R., and Reddly, D. R., "The hearsay-II speech-understanding system: Integrating knowledge to resolve uncertainty", Computing Surveys, 1980, 12, p. 213-253.

9717
CSO: 4009/1096

ALGORITHM FOR SAMPLING CHINESE WORD SIGNALS

Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese Vol 24 No 1, 1987 pp 52-54

[English abstract of article by Yang Changsheng [2799 7022 3932], et al., of Zhejiang University]

[Text] An algorithm for sampling Chinese word signals is presented. With this algorithm, the precise sample data for an isolated Chinese word utterance can be obtained. This experiment shows that the algorithm is simple and effective. (Paper received Jan 86.)

REFERENCES

[1] L. R. Rabiner and R. W. Schafer, "Digital Processing of Speech Signals, Prentice-Hall, Inc. 1978, Chapter 4.3~4.4.

[2] L. R. Rabiner and M. R. Sambur, "An Algorithm for Determining the End Points of Isolated Utterances", Bell Syst. Tech J. Vol. 54 No. 2, pp. 297-315, February 1975.

[3] 杨长生："汉语词汇声音的识别系统"，1985年浙江省计算机学会报告论文.

[4] E. Horowitz and S. Sahni, "Fundamentals of Data Structure", Pitman Publishing LTD., Chapter 3, pp. 82~86.

9717
CSO: 4009/1096

METHOD FOR DISCRIMINATING CHINESE HOMONYMS

Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese Vol 24 No 1, 1987 pp 46-51

[English abstract of article by Yang Changsheng [2799 7022 3932], et al., of Zhejiang University]

[Text] A method for discriminating Chinese homonyms in Hanyupinyin sentences is presented through morphology parsing and syntax analysis. This method has been implemented on an IBM personal computer IBM-PC XT. Using this system, the text in Hanyupinyin form can be converted automatically into text in Chinese character form. The correct ratio of the automatic conversion is up to 92 percent. (Paper received Jan 86.)

REFERENCES

[1] "汉语拼音音节索引", Index of Syllables of Hanyupinyin (the Phonetic Transcriptions of Chinese Characters).
[2] 王维贤、卢曼云, "现代汉语语法", 浙江人民出版社, 1981.1.
[3] 刘月华, 潘文娱, "实用现代汉语语法", 外语教学和研究出版社, 1983.4.
[4] W. A. Woods, "Transition Network for Language Analysis", Communications of the ACM, Volume 13/Number 10/October 1970.
[5] Yoh-han Pao and Chang-sheng Yang, "A Computer Intelligent System for Understanding Chinese Homonyms". pp. 841—847, "The First International Conference on Computers and Applications".

9717
CSO: 4009/1096

NEW CHINESE CONVERTIBLE PAGE TYPEWRITER KEYBOARD SYSTEM FOR WHOLE WORD INPUT

Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese Vol 24 No 1, 1987 pp 39-45

[English abstract of article by Lin Yuwei [2651 1342 1218] of Guangdong Institute of Test and Analysis]

[Text] Using an electronic variable character button (made by mounting a matrix symbolic display on an ordinary button), a new convertible pate Chinese specific typewriter keyboard can be made. By pressing different selective buttons on the keyboard, different keyboard pages (a set of characters consisting of 200 characters) can be shifted on the keyboard for typing with the whold word input method. The advantages of equipping Chinese electronic typewriters with this kind of keyboard include exemption from learning coding rules, one-word-for-one-button and high input speed, and also greatly decrease the total number of buttons, reaching the degree of a middle-sized keyboard. (Paper received Sep 85.)

9717
CSO: 4009/1096

METHODOLOGY OF CHINESE CHARACTER CODING (CCC) AND SYMBOLS FOR SHAPE-REPRESENTATION OF CHINESE CHARACTERS

Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese Vol 24 No 1, 1987 pp 20-38

[English abstract of article by Chen Aiwen [7115 1947 2429], et al.]

[Text] First, from the viewpoint of the present information society, the authors give a new definition of CCC, which is a second form of Chinese characters. The application of CCC is not limited to computer technology, but also extends to many other areas, such as compiling a dictionary, sending a telegraph or telex, or compiling indexes on cards or books. Therefore, CCC must be unified and widely adaptable, just as it is with Chinese characters, which is also an important criterion in evaluating a CCC scheme.

The design of the CCC scheme should be primarily based on the Chinese character's shape code, which reflects the inherent meanings of the Chinese characters. The shape code depends on the components of the Chinese characters. Therefore, the study of the structural law of a Chinese character's shape is the foundation for processing a Chinese character model.

Components are the letters of a Chinese character. According to the strict definition of components, the authors have divided all Chinese characters into nearly 400 components and, based on their definite features, classified the components into 2 series, 5 types, 13 forms and 49 categories, thereby establishing a systematic and coherent classification system for Chinese character components. This system can also be used as an important means of learning to read Chinese characters.

Based on the classification system of natural components, and through composing and decomposing, the 49 categories of components are arranged on the 31 keys of a standard computer by applying the laws of the Latin alphabet and numerals. These components are called "coding components" because they are sorted, named and put in order. The "bottleneck," i.e., the difficulties in CCC, is thus penetrated.

In this paper the authors present in detail the "symbols for shape-representation of Chinese characters" and a series of CCC schemes--computer code, pure shape code, pronunciation code which can distinguish homonyms, dictionary code, telegraph code and Chinese characters in Japanese and Korean. This CCC scheme is well suited for both simplified forms and original complex forms of Chinese characters. This method, which uses only one kind of basic symbol (or code name), enables the CCC to reach a high level of unity.
(Paper received Dec 85.)

REFERENCES

[1] 陈明远，«汉字编码研究的进展及分析»，载«汉字编码方案汇编»，第192页。科学技术文献出版社1980年版。
[2] 张普，«汉字部件分析的方法和理论»，载«中文信息处理国际研讨会论文集»第三集，第147～148页。
[3] «汉字宏观字形输入法(钱码)»。上海工业大学钱码课题组，1985年。
[4] 郭治方，«汉字编码的现状与发展»，载同[2]，第三集，第9页。

9717
CSO: 4009/1096

SOFTWARE ENGINEERING AND PROBLEM STATEMENT LANGUAGE/PROBLEM STATEMENT ANALYZER (PSL/PSA)

Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese Vol 24 No 1, 1987 pp 8-14

[English abstract of article by Xu Longshan [6079 7893 1472] of the Institute of Software, Chinese Academy of Sciences]

[Text] This paper shows how PSL/PSA may be used to provide a computer aid design for information processing and software engineering methodologies, and briefly describes the history of software engineering development. Structured system life cycle methods have been described in a number of publications. This paper is based on a synthesis of these publications and introduces the Problem Statement Language (PSL) and Problem Statement Analyzer (PSA).

PSL/PSA is a computer-aided technique for structured documentation and analysis of the information processing system. It is also an important tool for software engineering. As of now, China is estimated to be 15~20 years behind the international level in software engineering. (Paper received Oct 85.)

REFERENCES

[1] Teichroew, D. and E. A. Hershey, III, "PSL/PSA: A Computer-Aided Technique for Structured Documentation and Analysis of Information Processing Systems," IEEE Transactions on Software Engineering, Vol. SE-3, No. 1, pp. 41-48 (1977).

[2] PSL Language Reference Summary, A5.2, ISDOS Project, Department of Industrial and Operations Engineering, Dr. D. Teichrow, The University of Michigan, Ann Arbor, MI48109. U. S. A.

[3] PSA Command Reference Summary, A5.2. ISDOS Project Department of Industrial and Operations Engineering, Dr. D. Teichrow, The University of Michigan, Ann Arbor. MI48109. U. S. A.

[4] "Problem Statement Language (PSL)/Problem Statement Analyzer (PSA), User's Reference Manual, A5.2", ISDOS Project, Department of Industrial and Operations Engineering, The University of Michigan, Ann Arbor, MI 48109. U. S. A.

[5] Ross, D. T. and K. E. Schoman, Jr, "Structured Analysis for Requirements Definition," IEEE Transactions on Software Engineering, Vol. SE-3, No. 1, pp. 6-15 (1977).

[6] De Marco, T, Structured Analysis and System Specification, Yourdon Inc., New York, 1978.

[7] Dr. Surya B. Yadav, "Determining an Organizations Information Requirements: A State of the Art Survey", Data Base Spring, pp. 3-19, 1983.

[8] "The use of PSL/PSA with structured system development methodologies", ISDOS Project, Department of Industrial and Operations Engineering, The university of Michigan, Ann Arbor, MI48109, U. S. A.

9717
CSO: 4009/1096

KNOWLEDGE-BASED SYMBOLIC CIRCUIT ANALYSIS PROGRAM

Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese Vol 24 No 1, 1987 pp 1-3

[English abstract of article by Yang Qiaolin [2799 0829 2651], et al., of the Institute of Computing Technology, Chinese Academy of Sciences]

[Text] A knowledge-based symbolic circuit analysis program--SYMBANA--is introduced. With inputs and symbolic parameters, the program outputs the symbolic expression of the circuit functions, such as voltage gain Au = Vo/Vi, and the symbolic expression of sensitivity (∂Av/∂pi) for a given parameter (pi). Written in micro-prolog, SYMBANA uses knowledge processing and interference. It can be run on the IBM PC/XT, AT and compatible computers. SYMBANA can be used as a CAD/CAI tool in electronic fields. (Paper received Jan 86.)

REFERENCES

[1] L. W. Nagel, "SPICE 2: A Computer program to simulate semiconductor circuits" ERL Memo ERL-M520 Univ. of Califonia Berkeley May 1975.
[2] W. T. Weeks et al, "Algorithms for ASTAP——A network analysis program" IEEE Trans. Circuit Theory Vol. CT-20 pp. 628-634 Nov. 1973.
[3] B R. Chawla et al, "MOTIS-An MOS Timing Simulator" IEEE Trans. Circuit and Systems Vol. CAS-22 No. 12 Dec, 1975.
[4] 杨乔林，杨绍祺："电路分析系统DFX-1" 电子计算机动态 1976 年第四期.
[5] E. Lelarasme et al, "RELAX: A new circuit simulator for large scale MOS IC's" 19th Design Automation Conf. 1982.
[6] T. F. Gatts et al. "Topological analysis program for linear active network (TAPLAN)" Proc. 13th Widwest Symp. on Circuit Theory, May 1970.
[7] P. M. Lin and G. E. Alderson, "Symbolic network functions by a single pathfinding algorithm" Proc. 7 th Allerton Conf. Circuit and Systems pp. 196-205 Oct. 1969.
[8] G. E. Alderson and P. M. Lin, "Computer generation of symbolic network function——A new theory and implementation", IEEE Trans. Circuit Theory Vol. CT-20 pp. 48-56 Jan. 1973.
[9] S. W. Director and R. A. Rohrer, "Generalized adjoint network and network sensitivities". IEEE Trans. Circuit Theory, Vol. CT-16 pp. 318-323 1969.

9717
CSO: 4009/1096

METHOD OF STATUS ANALYSIS FOR AISC [ANSHAN IRON AND STEEL COMPANY] ENERGY MANAGEMENT OPERATION LANGUAGE

Beijing JISUANJI YANJIU YU FAZHAN [COMPUTER RESEARCH AND DEVELOPMENT] in Chinese Vol 24 No 1, 1987 pp 55-60

[English abstract of article by Yao Tianshun [1202 1131 7311], et al., of Northeast Institute of Technology, Shenyang]

[Text] This paper applies the theory of the Augment Transition Network (ATN) to syntax analysis. It comprises a part of Chinese language understanding and its man-machine language interface. The syntax analysis of the Chinese language is an interactive procedure. The computer programs make up the question-answer system in the energy management world.

The syntax processor adopts one time scan, calls the syntax and scans the status matrix in terms of current status and word features, and then decides whether the status is changed and where it goes to. It starts a semantic interpreter to complete the syntax analysis, objective generation and other necessary actions progressively.

The system is implemented in BASIC and is run on the TI 990/12 minicomputer. It uses a dictionary which includes the large major words of energy management operation language. Simple Chinese declarative sentences, interrogative sentences and imperative sentences have been tested on the machine and ideal results have been achieved. (Paper received Feb 86.)

9717
CSO: 4009/1096

IBM PC/XT SOFTWARE FOR PLOTTED CHINESE-CHARACTER GRAPHICS

Shenyang XIAOXING WEIXING JISUANJI XITONG [MINI-MICRO SYSTEMS] in Chinese
Vol 8, No 3, 1987 pp 5-10

[Article by Li Jinghua [2621 2533 5478], Zhang Hua [1728 5478], and Li Hui [2621 6540]: "IBM PC/XT Microcomputer Chinese Character Plotting and Function Extension System"]

[Text] Abstract:

This paper describes an IBM PC/XT microcomputer Chinese character plotting and function extension system. This system is composed of the IBM XT microcomputer and the SR-6602 plotter. Without adding any other hardware, this system uses software methods to call the CCDOS Chinese character library for Chinese character plotting. Besides its Chinese character functions, this system also has a plotting input function. Through keyboard operations one may plot, draw, make tables, and do curves; in terms of functions, it may be used in place of digitizers. In addition, it has a plotting library function, with which one can set up a plotting library, from which the user may call plotting library files to construct new plots.

I. Introduction

The SR-6602 plotter is an ordinary plotter in general use domestically. To make full use of this equipment, it can be connected to the IBM PC/XT for convenient use as computer-aided equipment. But because the AutoCAD software cannot directly support the SR-6602, and because the AutoCAD software can also not satisfy special needs of users, in this system we have done a series of research studies, from which we have obtained good results.

First of all, we have solved the integration of Chinese characters with plotting. We have used a handy method to implement Chinese character plotting on the SR-6602. This method calls the CCDOS Chinese character library, does the Chinese character plotting, and needs no separate purchase of another Chinese character library.

In using this system, we used data in dBASE III data files to draw on graphics displays and on plotter paper using histograms, percentage pie charts, and broken-line graphs, and we drew the Chinese characters for the record names

and field names on the plotting paper. In this way, we extended the dBASE III functions, adding to them that of Chinese character plotting.

The significance of bringing Chinese characters to this is that, first, we have made use of the CCDOS Chinese character library, replacing the vector Chinese character library used in current plotting. Because Chinese characters belong to a large character set and not to the small character set of Western languages, if we want to establish a usable Chinese character library, we would need 200K bytes of storage. If we were to use the software library, we would bring that into memory when accessing it, and the amount of storage capacity that would take is quite remarkable. Even if we do not use the software library and use a hardware library instead, although we can say that this does not then take up memory, the expense of that hardware is considerable. To be economical, some of them use a partial character library to be more suitable to the needs of particular fields. Even so, a certain expense in entailed. Second, it is useful when processing image data. Regarding the problem of both displaying and plotting Chinese characters, or of graphics processing of the aforementioned dBASE III data files, these may all be resolved conveniently. Third, we have made full use of the strengths of the dot matrix character form library. We can handle character fonts of differing qualities and non-Chinese characters, as for example tabular characters and graphics symbols. These are things that low quality font skeletal vectored Chinese characters cannot resolve.

We then resolved the problem of integrating digital data with plots.

The plotter is a graphics output device, but in using the software methods we have expanded these functions to treat this as graphics input equipment. Through keyboard operations, plotting, drawing, making tables, and curve input, the user can use this to replace digitizers. This method not only makes multiple use of a single object, but also resolves the demands of certain special uses. As for example in earthquake prevention research, investigators must plot on the same piece of paper simple graphs from the measured objects and the waveform charts resulting from testing and processing. Were they to use ordinary digitizers and plotters, this would be difficult to accomplish. Naturally, for implementing graphics and digital data integration, there are display devices and mice. But their resolution of 640 X 200 (or 320 X 200) cannot compare with the 3,850 X 2,700 of the plotter.

Also, there is the graphics library function.

Through keyboard command operations, we have implemented the functions of setting up graphics, storing graphics, and outputting graphics. In outputting graphics, we can do graphics tracing or graphics editing. The graphics library may be called from any place on the paper to compose a new graphic. In this way, the fundamental requirements for aided design is satisfied.

II. The Principles of the System Design

This system has been based on the working principles of technologies such as communications and intelligent peripherals interfaces and that of Chinese

characters, it has been in accordance with the demands for aided design, and has finally been implemented through software engineering.

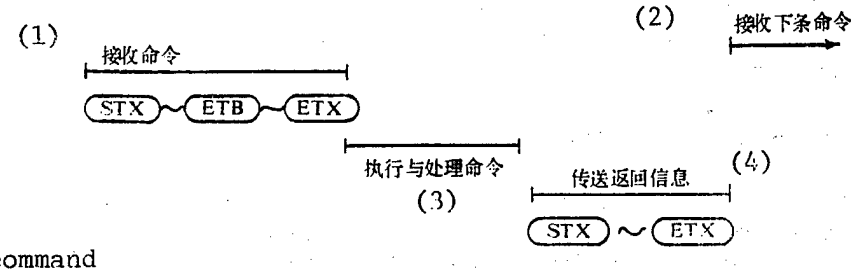
1. Communications technology

The connection between the host IBM PC/XT and the SR-6602 plotter has been made through the asynchronous communications method. There is an independent Z80 controlled system within the plotter, and the connection is made through its RS-232C interface and the IBM PC/XT RS-232C interface. In accordance with commands the SR-6602 receives from the host, and after these have been processed and executed, the principle of automatically returning information accomplishes the mutual communications between the two devices. To allow the plotter to work more effectively, this principle is the first problem that should be considered during the creation process.

2. Intelligent peripheral interface technologies

The SR-6602 is fitted with the intelligent peripheral interface (IPI). This satisfies the requirements of the layered IPI structure as determined by the ANSC protocol. These levels are divided into leve0, leve1, leve2, . . . leve5, or even higher. Within this, the leve0 and leve1 are physical interfaces, which must be simple, uniform, and standardized. The SR-6602 itself has three kinds of interfaces (RS-232C, GP-IB, and Centronix) that provide these properties. The logical interfaces are the various levels from leve2 on up, which are the focus of what makes it intelligent. As the intelligence is improved, the number of levels increases. This interface should resolve blocks, intelligent commands, command queues, and timing relations.

The process of information exchange and timing relations between the IBM PC/XT and the SR-6602 may be shown as follows:



Key: (1) Receive command
(2) Receive next command
(3) Execute & process command
(4) Send back information

in which STX--text transmission begins; ETX--text transmission concludes; ETB--block transmission concludes.

A. Host transmits ASCII coded commands to the plotter.

The command format is:

CC(T)

CC; 00, 00, 00(T)

CC; 00(S)CC; 00, 00, 00 (S)CC(T)

where CC is the command, represented by uppercase English letters, of which there are 30 plot commands;
00 is the parameter, where its greatest value is 32,767 and a semi-colon is used as a separator between the command and the parameter;
circled T represents the terminator, defined as the EX command, normally represented by letters and digits;
circled S is a continuance symbol, indicating conclusion of a block.

This plotter treats each plot command as a block. At each instance of text transmission, a number of commands may be successively transmitted, that is, a number of blocks. The number of commands is determined by the size of the plotter reception buffer, and since this one has only 512 bytes, this problem should be kept in mind during programming.

B. The plotter sends back information to the host computer

After each process and execution of a command, the plotter automatically sends back to the host computer either a 0, 1, or 2. These represent normal, can plot, and cannot plot, respectively. The user may also use the WH and RI commands to query the current plotter state (the pen coordinates, starting point, released pen state, pen number, scale, etc.) and error cause. These intelligent characteristics may only be fully realized during asynchronous communications. The feedback information of the current plotter state is quite similar to that of a digitizer, which sends digital information to the host regarding pen coordinates. Where the two are different is only in the physical factors generated by the pen coordinate information. In accordance with this principle, we have treated the plotter as graphics input as a substitute for a digitizer.

C. Chinese character technology

The Chinese-character plotting has been implemented in accordance with the design philosophy of the CCBIOS INT10 display management module. Through INT10, Chinese characters are shown in a 16 X 16 matrix, using the raster scan method, which is then written to the screen. And we have used a similar method to read out the displayed Chinese character matrix information and send that to the plotter for plotting. When scanning, each encounter with a '1' data will be converted to a plotter drop pen command, or a line will be drawn between two successive '1's. Progressive scanning of this sort will result in the gradual plotting of a Chinese character. When it is necessary to write Chinese characters, the Chinese characters will be transferred to the screen display area and displayed in the upper left corner, to be sent to the plotter determined positions one by one. Input of Chinese characters may be by keyboard, or they may be input through programs, that method being through the normal CCDOS Chinese character input method. The size of the Chinese character fonts and spacing may be arbitrarily selected by the user. It is

even simpler to send Chinese characters to the plotter in this way than to print Chinese characters by a printer through INT17, for there is no need to convert the font matrix, and font selection is much more convenient than processing by a printer.

III. The Methods of Software Design

In accordance with the needs of users and following the standards of aided design, we have used the methods of software engineering to do the designing.

1. Analysis of the user needs

Users need Chinese character plotting, and it should be as economical as possible, and convenient; they need to integrate plot output and plot input (plot output is an original function of the plotter, and is its normal usage, so this paper will provide no further discussion). They need to be able to plot, to draw and tabulate, to input curves, and these operations should be as convenient as possible. To meet these needs, we have used a method that calls the CCDOS Chinese character library to do Chinese character plotting. The integration of plots with digital data satisfies the integration of plot output with plot input. As for using the plotter for plot input, in keeping with plot characteristics, we have made fine distinctions in the design of the shift pen operations, seeking to improve the flexibility. We have used all operations complementary to the keys on the small keyboard to meet the needs of flexibility. We have used 8 numeric keys to control pen shifts in 8 directions; we use the plus and minus keys to select the expansion or reduction factor for the step length; using the step length to control the factor together with the eight direction keys meets the need for drawing all plots. We have set up a special key operation for the common connection of two points. To meet the demand for setting up a plot library for aided design, we have designed special function command keys for plot-library management, which establish the plot library, call the plot library, output the plot library to make a new plot, and which also have a simple plot editing function, a design plot trace and plot revision function, and also have plot rotation and plot expansion and reduction functions.

2. Structured analysis methods

The structured analysis method is abbreviated "the SA method." This is a simple and practical widely used method. To undertake the design of this method and to express its functions, we have used the SA method's "top down graded disassembly" format to make the following analysis of data flow.

The user enters the data he wishes to process into the system through keyboard input. After the system has accepted this data it classifies it according to the user requirements, which occurs at the top level of the system. This abstractly expresses the system functions as initialization, plot construction, output of plot, and revision of plot. After this, there is a gradual disassembly of each set of functions going downward. As for example with the function to construct the plot, which is disassembled as an action, calling subplots, rotating the plot, and writing the characters. The action phase may be further disassembled as pen position movements and plot commands.

The lowest level is a particular description of each detail. The middle levels are the transition process from the abstract to the particular. In using this method, other functions may be disassembled as well, as for example the function to revise a plot, which may be disassembled into the functions of adding pen strokes and deleting pen strokes. Therefore, it is easier to systematically analyze the system that is to be designed.

To describe the graded disassembly of the SA method, we use data flow charts. From the point of view of data flow, to describe each component of the system we show the relations for the data in each portion. Figure 1 shows the SA method data flow chart for this system. This data flow chart uses four plots to represent the fundamental components: arrows show the directions of data flow; circles show the processing of the data; vertical lines represent saved files; and rectangles represent the originating and terminating points of the data.

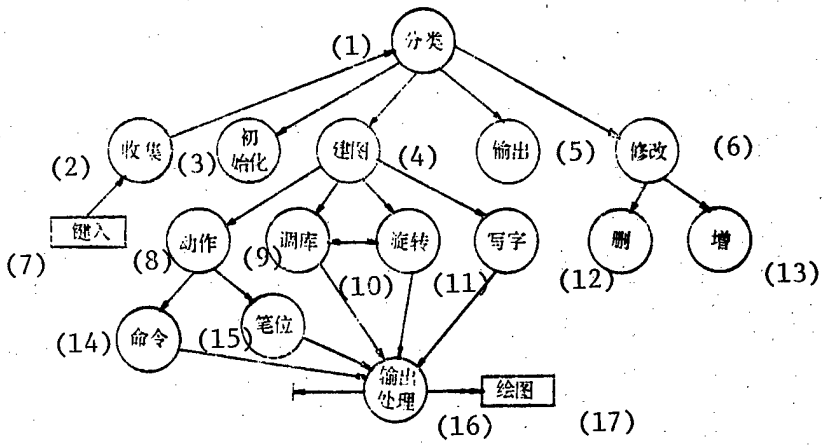


Figure 1. SA Data Flowchart for the Plotting System

1. classification
2. collection
3. initialization
4. plot construction
5. output
6. revision
7. keyboard input
8. actions
9. call libraries
10. rotate
11. write characters
12. delete
13. add
14. command
15. pen position
16. output processing
17. plot

3. The Structural Design Method

We have used the structural design method (SD method, for short) to design this system. The basic philosophy behind the SD method is to design the system in modules that are independent and have single functions. In the SA method described above, after the data flow has been disassembled in a graded manner from top to bottom, it is very easy to obtain a chart of the structure modules. The top module uses menu techniques to express its functions. The modules below that process by conditional branching, where the lowest level

are modules that implement certain particular functions. A structure module chart for this system is shown in figure 2.

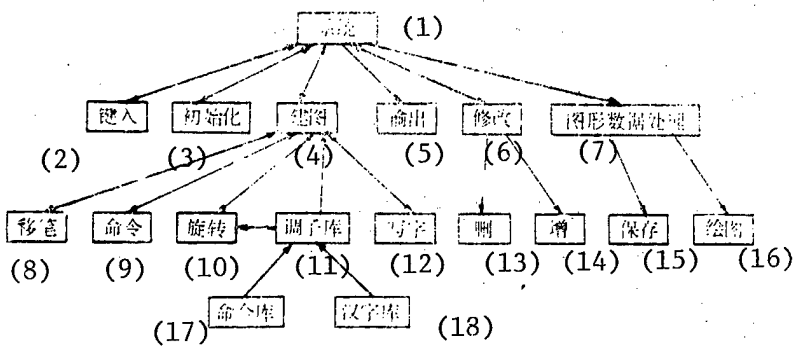


Figure 2. Structural Module Chart for this System

1. system
2. keyboard input
3. initialization
4. construct plots
5. output
6. revise
7. plot data processing
8. move pen
9. command
10. rotate
11. call subroutine library
12. write characters
13. delete
14. add
15. save
16. plot
17. command library
18. Chinese character library

The function of the top level module is as the main menu, which expresses the primary functions of the system using an interactive branch processing method.

Main menu:
0 initialization function
1 construct plot or augment function
2 output plot function
3 revise plot function
4 exit system

In addition to this, it also takes care of system input and output management.

The lowest level module specifically accomplishes the details of the functions of each component. As for example the move pen, command, call subroutine library, rotate, Chinese character, and non-Chinese character details in the construct plot function.

The modules in each of the middle levels are responsible for the functions of branch processing and management of calls at all levels.

All methods that make system design into independent modules can independently resolve each module, can independently write them, can independently test them, and can independently revise them. This not only simplifies system design, but also improves the reliability of the system. This is because of

the independence of the modules, which can prevent errors in the proliferation of the modules.

When resolving the modules, one should pay attention to keeping relations between them as few as possible, with the relations within the module being greater. When designing the system, program optimization cannot be the sole goal, thereby neglecting the independence of the modules, and consequently weakening the characteristics of the SD method.

IV. A Particular Implementation of the System

This system has been designed using the BASICA language. BASICA is an elementary language that is inexpensive and common, and is powerful. For these reasons, it may be used to implement the system design.

This system fundamentally resolves data processing problems for non-numeric values. It is quite reasonable to use the BASICA data file formats to organize these large amounts of data. And because the command formats for the plotter are represented in ASCII code, we have stored the data in the sequential file format.

This system sets up three types of data files.

First, is a file that handles the plot commands for the plotter. Because the plot commands are transmitted asynchronously, this requires handling by a COM file. We use the COM/communications port, the physical addresses of which are from 3F8h to 3FEh, and we use a 5-wire cable for communication between the two devices. Connections are through the numbers 2 and 3 pins of a D-plug connected together, the 4 and 5 pins connected together, and the corresponding 7 pin.

Before using the communications file, the user must open this file, after which it may be read and written to, and should be closed when finished.

```
OPEN"COM/:9600, N, 8, 1, CS, DS, CD" AS#1
```

Open communications file 1, which sets the communications protocol. The communications protocol of the SR-6602 plotter is set through SW1 and SW2 on the rear board.

Here is an example of issuing commands to the plotter:

```
PRINT #1"EX; [0D][0A]"
```

Send the command to define the terminator.

```
PRINT #1"EB; & [0D][0A]"
```

Send the command to define the block terminator.

```
PRINT #1"IN & SP; 1[0D][0A]"
```

Send the command to initialize the plotter and set the pen speed to 1.

```
PRINT #1"AP; 100, 100, 2[0D][0A]"
```

Send the command to move the pen. Move the pen from the current position to a position that is X=100 and Y=100 steps from the home coordinates (where each step is 0.1 mm).

```
PRINT #1"HM[0D][0A]"
PRINT #1"TE[0D][0A]"
```

Plot end command.

```
CLOSE(1)
```

Second, is the file to set up plot data.

In the process to construct plots, all operations undertaken, including: plotting movements (pen position record, plot command usage), and the data generated by the operations of calls to subroutine plot libraries, rotation, and writing characters, are all stored in the data file the name of which is provided by the user, which helps the user in reuse.

Third, is the file for intermediate temporary storage in constructing the plot files. This is because the revision and augmentation of sequential files is rather difficult. To aid in that revision, an intermediate file is always set up with which to undertake the revision. In this way revision can be in the temporary file, which will not harm the constructed plot file. Finally, the revised temporary storage file is copied to the data file with the file name for use in output. The operation is as follows:

```
OPEN "temporary storage" FOR INPUT AS #2
OPEN filename FOR OUTPUT AS #3
WHILE NOT EOF (2)
    LINE INPUT #2, SP$
    PRINT #3, SP$
WEND
CLOSE (2), CLOSE (3)
```

The records in the data file just mentioned are all the plotting commands and the commands for each portion of functions. If the plotting commands are in the command format described above, the operations for the function commands are as follows:

Calls subroutine plot library file	$ filename
Rotation of the plot file	%$ filename
Write Chinese characters	# Chinese character
Write English	AS; X,Y,H,Q, ABCD

where X and Y are the coordinates of the first letter. H is the height of the character. Q is the included angle between the character string and the X axis. ABCD is the character string to be written.

V. Conclusion

This system, using CCDOS Chinese character plotting, is an economical and convenient plotting system because the IBM PC/XT computers are in wide use, and many SR-6602 plotters have been imported. Therefore, there are bright prospects for the broad use of this kind of software. In addition, since the design of this kind of software is simple, development costs have been low. This system can do dBASE III Chinese character plotting, can manage the plotting of data, and will become software welcomed by a large number of users. These methods of Sinicization are simple, economical, and practical, and can be transferred to use with other aided design software.

This design philosophy where one plotter is put to multiple uses, is of great significance to departments where funds are tight. The methods for designing this software may be used on other plotters.

12586
CSO: 4008/1072

INFLUENCE OF Ag CONTENT ON OPTICAL PROPERTIES OF Ag-Cs_2O THIN FILMS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 2, Feb 87 pp 264-269

[English abstract of article by Li Jianping* [2621 1696 1627], et al., of the Department of Radio Electronics, Beijing University]

[Text] The variations of glass reflectance or front reflectance R_f, vacuum reflectance R_v and transmittance T of well activated cesium oxide thin films with an Ag addition have been measured within the visible and infrared ranges. R_v increases as the amount of Ag increases, but R_f decreases at first, then increases. Optical absorptions of the thin film and silver particles increase as the amount of Ag increases, with the photoemission increasing at first, then decreasing. A model with inhomogeneous distribution of silver particles is proposed.

* Presently at the Institute of Electronics, Chinese Academy of Sciences.

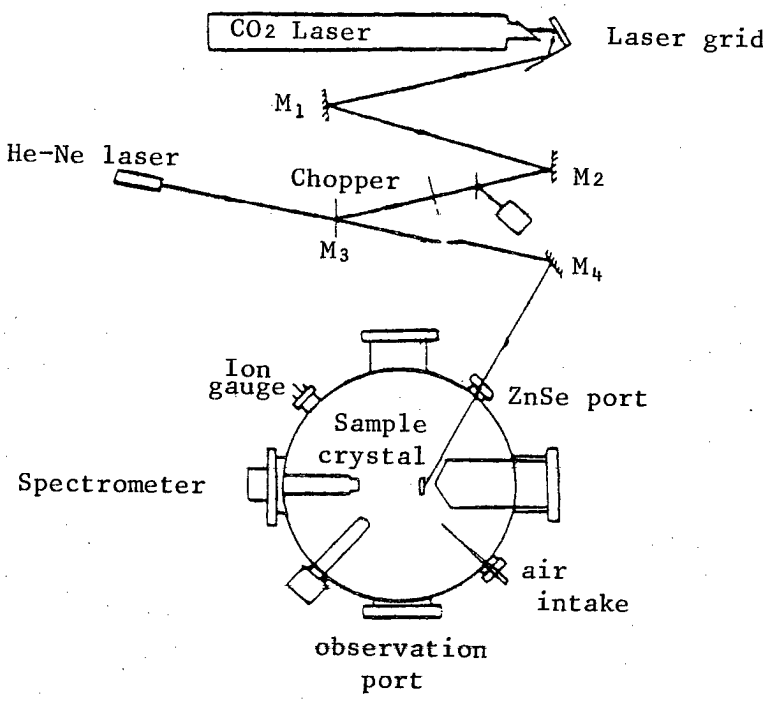
9717
CSO: 4009/34

VIBRATIONAL MODES OF MACROMOLECULAR ADSORBATE INVESTIGATED BY PHOTOACOUSTIC SPECTROSCOPY

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 2, Feb 87 pp 270-274

[English abstract of article by Wu Mingcheng [0702 7686 2052], et al., of the Surface Physics Laboratory, Fudan University; Lu Huizong [7120 1920 1350], et al., of the Laboratory of Laser Physics and Optics, Fudan University]

[Text] Under UHV conditions, the C-O stretching mode properties of diacetate cellulous ($C_2H_8O_3$-$(COOCH_3)_2$) adsorbed on a polycrystalline Ag surface were studied using PAS. The peak positions, peak shifts and FWHMs of the vibrational mode at different adsorbate coverages and different temperatures were demonstrated. Some features of adsorption of macromolecules on metal are discussed. The results also show that the described facility has satisfactory sensitivity for surface submonolayer detection.



9717
CSO: 4009/34

V-V ENERGY TRANSFER IN DISSOCIATION PROCESS OF FREON 113 MOLECULES IN MULTI-FREQUENCY INTENSE IR LASER FIELDS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 2, Feb 87 pp 259-263

[English abstract of article by Yang Lishu [2799 4539 2579], et al., of Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Hefei]

[Text] Freon 113 molecules are superexcited in multifrequency intense IR laser fields composed of 9P(24), 9P(22), 9P(20), 9P(18) lines of a TEA CO_2 laser, reaching very high excited states. It can be seen from the decomposition curve that a "siphonage effect" exists in the V-V energy transfer between $CF_2Cl \cdot CFCl_2$ and $CF_3 \cdot CCl_3$ molecules. From the main products, C_2F_6, C_2Cl_6, C_2F_4 and $C_2F_2Cl_2$, it is shown that the C-C bonds having higher energy in $CF_2Cl \cdot CFCl_2$ and $CF_3 \cdot CCl_3$ are mostly broken, but only a few C-Cl bands having the lowest energy ruptured. The authors propose a dissociation mechanism of Freon 113 molecules in multifrequency intense IR fields, and indicate that the intramolecular V-V energy transfer is not randomized.

9717
CSO: 4009/34

PROFILE OF CURRENT DRIVEN BY LOWER HYBRID WAVES IN TOKAMAKS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 2, Feb 87 pp 230-236

[English abstract of article by Yin Yongxiang [0603 3057 4382], et al., of Southwestern Institute of Physics, Leshan, Sichuan]

[Text] The downshift of the lower velocity limit of resonant electrons in Landau damping due to the trapping of electrons in the potential barrier formed by the large-amplitude electrostatic waves is considered. By means of the ray-tracing method, the energy deposition of LHW on its trajectory in tokamaks is computed. Considering the balance between the energy deposition and the Joule heating effect of the LHW driven current, the profile of the LHW driven current in tokamaks has been obtained. The calculated results of PLT and JFT-2 are in agreement with the experimental results. The computed results for the HL-1 device are also optimistic.

9717
CSO: 4009/34

HIGHER-ORDER HARMONICS EMISSION IN CO_2-LASER IRRADIATED TARGETS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 2, Feb 87 pp 224-229

[English abstract of article by Xu Zhizhan [1776 5267 1455], et al., of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] In this paper, the authors extend their previous work and calculate the field structure and conversion efficiency of higher order harmonics emission. In the calculation, the effect of the density profile steepening in the vicinity of the critical density has been taken into account by assuming a bilinear density profile. The analytical results obtained can provide a reasonable explanation for the physical phenomena observed in the CO_2-laser experiments.

9717
CSO: 4009/34

INFLUENCE OF DIMENSIONS OF STEPPED HORNS WITH PIEZOELECTRIC TRANSDUCER ON PERFORMANCE OF VIBRATORS

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 2, Feb 87 pp 208-216

[English abstract of article by Ma Yuying [7456 3768 5391], et al., of the Institute of Applied Acoustics, Shanxi Teachers University, Xi'an]

[Text] In this paper, the authors discuss two types of vibrators, that connected by a single screw and that by a strain shell. The thick-end lengths of stepped horns are varied to determine their influence on the thin-end length, the gain of displacement amplitude and the variation of the displacement amplitude at the thin end. Optimal thick-end lengths are then selected out. For the vibrator connected by a strain shell, the displacement and amplitude of the thin end and the relationships among resonant frequencies and diameters of both the thick end and thin end are determined. The relationship between the thin-end length and resonant frequencies is also studied. The method for designing improved vibrators is given.

9717
CSO: 4009/34

LOCALIZATION AND CORRELATION EFFECT OF POTENTIAL FOR STRUCTURAL MODELING OF BINARY AMORPHOUS ALLOY

Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 36 No 2, Feb 87 pp 172-182

[English abstract of article by Wang Jinghan [3769 0079 3352] and Li Dexiu [2621 1795 0208] of the Department of Physics, Yunnan University; Chen Jinchang [7115 6885 2490] of the Department of Physics, Beijing Teacher's College; Zhan Wenshan [6124 2429 1432], et al., of the Institute of Physics, Chinese Academy of Sciences; Wang Xuwei [3769 4872 1218] of the Department of Applied Mathematics and Physics, Beijing Institute of Aeronautics and Astronautics]

[Text] The primary DRPHS configurations are relaxed with Lenard-Jones and Morse potentials respectively for the $Co_{81}P_{19}$ and $Ni_{64}B_{36}$ amorphous alloys. Two displacement fractions, f = 0.005 and f = 1, are considered in the case of $Ni_{64}B_{36}$. Total energy, reduced partial distribution function and angular distribution function are obtained from the calculated data. The effect of localization and correlation of potential function on the chemical short range order in binary amorphous alloys is discussed.

9717
CSO: 4009/34

LASER CORRELATION IMAGING OF UHF ACOUSTIC STANDING WAVEFRONT

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 2, Feb 87 pp 175-180

[English abstract of article by Yi Ming [2496 2494], et al., of the Department of Physics, Nanjing University]

[Text] Based on Fourier optics, the authors have analyzed the far-field of a laser beam passing through the UHF acoustic standing waves and found that there is a temporal spectrum in the spatial spectrum on the far-field plane in addition to the spatial spectrum itself. In accordance with these results, the authors have developed an imaging principle of UHF acoustic standing wavefronts. By temporal cross correlation, the non-zero value of correlation of the same temporal frequencies in the different spatial frequencies is obtained. Then, by intensity linear superposition of incoherent light of the different temporal frequencies, a stable visible image of UHF acoustic standing wavefronts is obtained. Therefore, the authors have not only clarified the confusion surrounding the theory, but have also developed a new method for imaging the UHF acoustic standing wavefronts. The results have been proved experimentally.

9717
CSO: 4009/38

QUANTUM THEORY AND EXPERIMENTAL STUDY OF LASER POLARIZATION

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 2, Feb 87 pp 97-104

[English abstract of article by Guo Siji [6665 1570 0679], et al., of Northwest Telecommunications Engineering Institute, Xi'an]

[Text] The full quantum theory of laser polarization is presented in this paper. The polarization properties of multimode laser beams in anisotropic cavities are analyzed. Basic equations, calculation curves and polarization configurations describing the inter-angle of mode polarization directions in a 6328 Å He-Ne laser vs anisotropy are given. The effects of the phase anisotropy on mode polarization by stress are investigated. The experimental results and theory analysis coincide.

9717
CSO: 4009/38

STUDY OF THERMAL GAS LENS IN SELF-HEATED COPPER VAPOR LASERS

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 2, Feb 87 pp 112-119

[English abstract of article by Sheng Qimin [3088 3825 2404], et al., of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] An analysis of the thermal gas lens in the discharge tube of a self-heated copper vapor laser (CVL) is given. For the different schemes of copper vapor lasers, it is found that the steady-state CVL can be equivalent to a convex or concave lens. As a result of the experiment, the relationships between the focal length of the thermal gas lens and the input power and buffer gas pressure are presented. The evolution process of the thermal gas lens from concave to convex is described.

9717
CSO: 4009/38

MECHANISM OF OPTOGALVANIC SIGNAL GENERATED IN CO_2-N_2 MIXTURE SYSTEMS

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 2, Feb 87 pp 134-138

[English abstract of article by Zhou Guangdi [0719 0342 0966], et al., of the Institute of Mechanics, Chinese Academy of Sciences]

[Text] The optogalvanic signal (AGS) in a CO_2-N_2 discharge tube irradiated by a CO_2 laser has been measured by a narrow band-pass filter, and the electron energy distribution (EED) has been measured by a second-order differential circuit. It is considered that OGS in the CO_2-N_2 discharge tube is generated through step ionization when CO_2 and N_2 molecules in electric excited states are disturbed, and the rate of step ionization is changed by 10.6 μm laser irradiation.

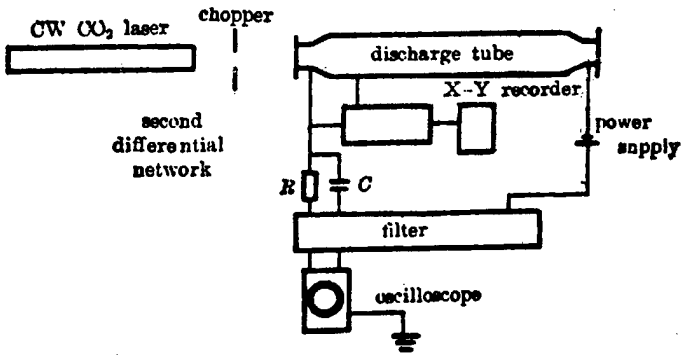


Fig. 1 Experimental Apparatus

9717
CSO: 4009/38

TELESCOPIC RESONATORS FOR DYNAMIC STABLE TEM_{00} MODE OPERATION

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 2, Feb 87 pp 105-111

[English abstract of article by Lü Baida [0712 4102 6671] of the Department of Physics, Sichuan University, Chengdu]

[Text] In general, the condition for thermal stability of telescopic resonators in TEM_{00} mode operation is derived using equivalent resonators and the transfer matrix method. The expression is simple but strict, and can be generalized easily to multielement resonators with many internal lenses, one of which is a thermal lens. The results are compared to those obtained by approximate methods and a discussion is presented.

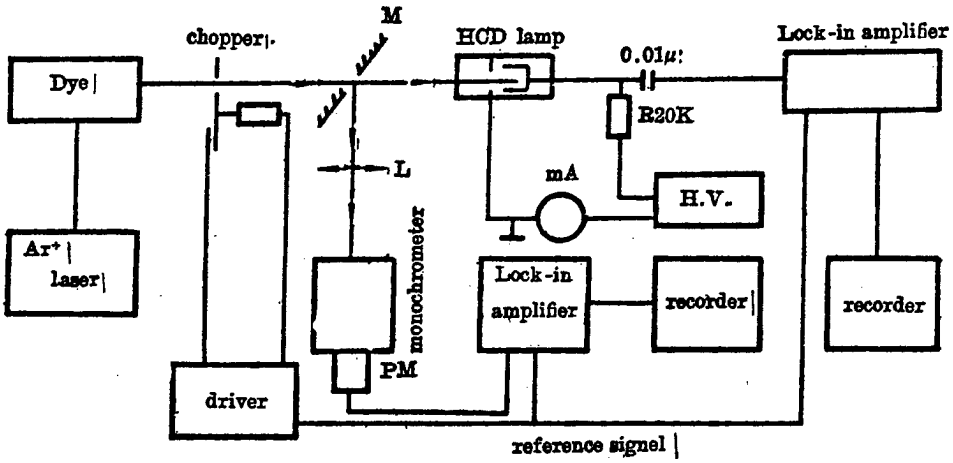
9717
CSO: 4009/38

EXPERIMENTAL AND THEORETICAL INVESTIGATION OF ANOMALOUS SIGNAL IN Ne CW OPTOGALVANIC SPECTROSCOPY

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 2, Feb 87 pp 126-133

[English abstract of article by Yin Lifeng [3009 4539 1476], et al., of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] Based on the measured results using the technique of sensitivity fluorescence spectroscopy and the improved theoretical model previously suggested by the authors, the mechanism of anomalous optogalvanic signals induced by a CW laser tuned to the resonance frequency between the transitions of Ne $1s_3$, $1s_5$ and 2p levels is explained satisfactorily.



Experimental setup for measuring the OGS spectrum and sensitivity fluorescence spectrum

9717
CSO: 4009/38

STUDY OF SELF-FREQUENCY-DOUBLING FROM 1.06 TO 0.53 μm WITH MULTI-FUNCTIONAL CRYSTAL NYAB

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 2, Feb 87 pp 139-143

[English abstract of article by Liu Enquan [0491 1869 3123], et al., of the Optical Department, Shandong University, Jinan; Lu Baosheng [7120 1405 3932], et al., of the Institute of Crystal Materials, Shandong University, Jinan]

[Text] A new excited emission/nonlinear multi-functional rare earth borate crystal $Nd_xY_{1-x}Al_3(BO_3)_4$ (NYAB) has been developed. The effective nonlinear coefficient of type I phase matching $\chi^I_{eff} = 4.056 \times 10^{-9}$ e.s.u. is four times more than that of the KDP crystal if the phase matching conditions are satisfied. The measured value by the SHG method is in good agreement with this data. Using the tunable dye laser (Datachrom-5000) as the pumping source, the laser self-frequency-doubling output from the NYAB crystal at 1.06 μm ~ 0.53 μm is obtained for the first time. The threshold energy measured is less than 2 mJ, maximum conversion efficiency is 14.3 percent, and the output energy at 0.53 μm is 5 mJ.

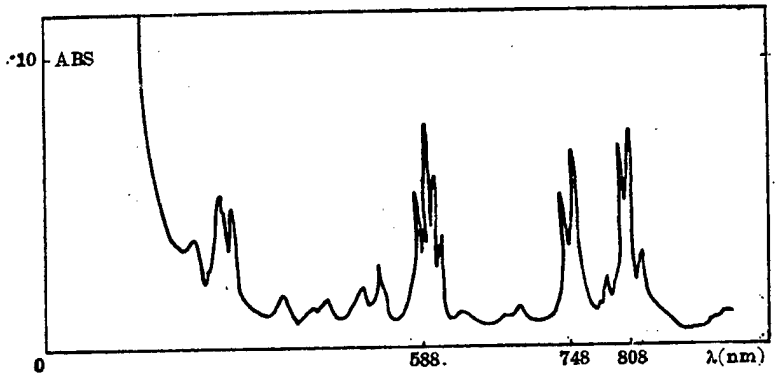


Fig. 1 Absorption spectrum of NYAB crystal

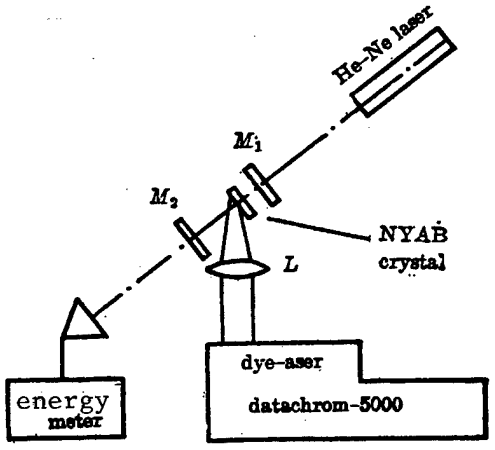


Fig. 2 Experimental setup for 1.06~0.53 μm self-frequency doubling effect

9717
CSO: 4009/38

BROAD-BAND SHG OF Q-SWITCHED ND:GLASS LASER

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 2, Feb 87 pp 151-158

[English abstract of article by Qin Wenhua [6009 2429 7520], et al., of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] The coupling equations describing broad-band laser nonlinear interaction are presented. Several types of frequency-doublers are used for broad-band SHG of a Nd:glass Q-switched laser system with $\Delta\lambda$(FWHM) = 60 Å. The experimental results agree very well with the theoretical ones.

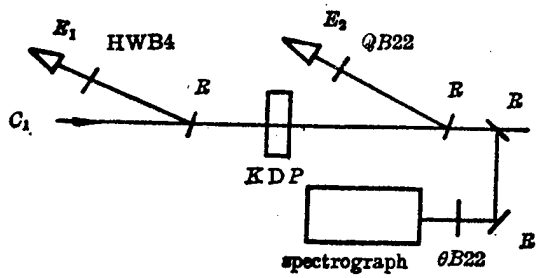


Fig. 2 Experimental arrangement

E_1, E_2—calorimeters; HWB4—filter; QB22—filter; R—reflection mirror; S—spectrometer

9717
CSO: 4009/38

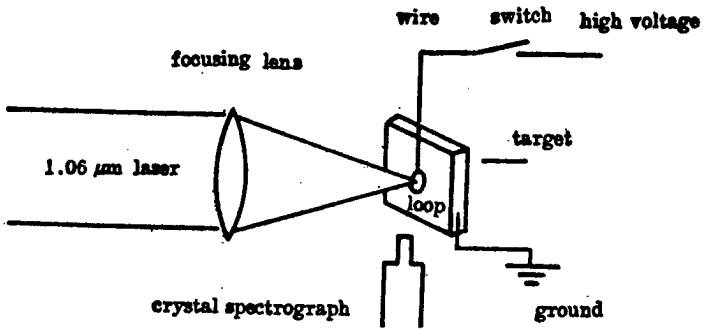
ENHANCEMENT OF X-RAY EMISSION FROM LASER PLASMA IN HIGH FREQUENCY ELECTRIC FIELD

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7 No 2, Feb 87 pp 171-174

[English abstract of article by Feng Xianping [7458 6343 1627], et al., of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] It was found experimentally that X-ray emissions were enhanced from GaAs and Zn plasmas irradiated by a Nd:glass laser pulse with a width of 2 ns and on a target power density of 5×10^{13} W/cm^2 in a high frequency electric field in a 0.1 Torr air atmosphere. The intensity of the X-rays was much stronger in the presence of the high frequency field than without it. The ratios of the intensity $\alpha = I_{(field)}/I_{(no\ field)}$ were determined from the obtained spectra; however, the plasma temperature deduced from the recombination continuum was lower in the presence of the high frequency electric field (T_e = 300 eV) than without it (T_e = 430 eV).

The authors also performed the same experiment using Zn and similar results were obtained.



Schematic of the experimental set up for taking the X-ray spectrum of laser plasma

9717
CSO: 4009/38

ANALYTICAL AVERAGE MODEL OF STUDIES ON ORBITAL RESONANCE

Beijing TIANWEN XUEBAO [ACTA ASTRONOMICA SINICA] in Chinese Vol 28 No 1, Mar 87 pp 11-24

[English abstract of article by Liao Xinhao [1675 2450 3185] of Beijing Observatory, Chinese Academy of Sciences; Liu Lin [0491 2651] of the Astronomy Department, Nanjing University]

[Text] For a long time, from the aspect of gravitation, there are two mathematical models for studying orbital resonance: practical and averaged models. It is not convenient to use the practical model because it is devoid of simplifications in the dynamic systems discussed and fast variations are contained in the perturbation function. For this reason, most of the authors use the averaged model in which the perturbation function is averaged and the fast variations are cancelled. The averaged model is classified by numerical averaged and ideal resonant models, called Schubart's and Garfinkel's models respectively.

Based on Schubart's model, the perturbation function of the system is expanded trigonometrically in the mean anomaly of the perturbed and perturbing bodies. The secular and resonant terms are taken in the meaning of the first order. Therefore, the authors obtain H_L, the Hamiltonian of the resonant system, as follows:

$$H_L = 1/2a + R_c + R_1 + R_r$$

H_L is called the analytical averaged model.

H_L is discussed in detail and compared with Schubart's model and a practical model, respectively. It is seen that it is significant to establish H_L and convenient for researching the characteristics and evolution of orbital resonance.

9717
CSO: 4009/48

COMPUTATIONAL METHOD FOR ORBIT IMPROVEMENT FOR SHORT ARC OBSERVATIONS OF ARTIFICIAL SATELLITES

Beijing TIANWEN XUEBAO [ACTA ASTRONOMICA SINICA] in Chinese Vol 28 No 1, Mar 87 pp 6-10

[English abstract of article by Liu Yaying [0491 0068 5391] of Purple Mountain Observatory, Chinese Academy of Sciences]

[Text] According to the principle that the influence of atmospheric drag on the orbit perigee is far less than that on the eccentricity, a computational method for orbit improvement using the orbit perigee as the restraint condition is derived in this paper. It is of practical use in improving the accuracy of orbit determination by short arc visual observations, especially the accuracy of the orbit perigee.

9717
CSO: 4009/48

ON AIR-DRAG PERTURBATION OF TRANSIT SATELLITE AND SELECTION OF PARAMETERS IN ORBIT IMPROVEMENT

Beijing TIANWEN XUEBAO [ACTA ASTRONOMICA SINICA] in Chinese Vol 28 No 1, Mar 87 pp 1-5

[English abstract of article by Wu Lianda [0702 6647 1129] of Purple Mountain Observatory, Chinese Academy of Sciences]

[Text] In this paper, the air-drag perturbation of a transit satellite is discussed in detail. It is shown that the perturbation of transit will display anomalies complicated in the period of maximum solar activity. Therefore, in precise orbit determination, great attention must be paid to it. In addition, the author also discusses how to select the air density model and parameters in the orbit determination. The authors have studied variations of the selected parameters with the arc length.

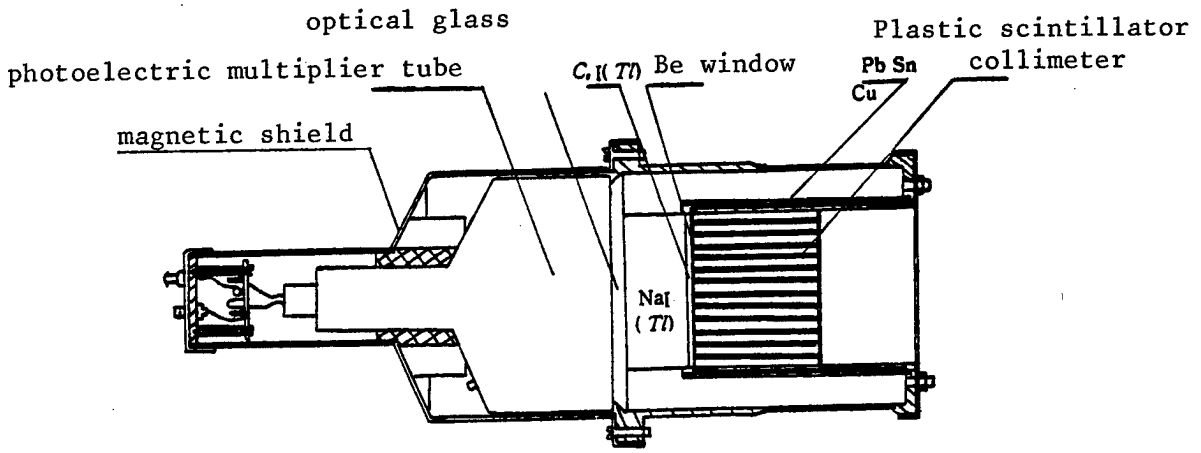
9717
CSO: 4009/48

HARD X-RAY TELESCOPE HAPI-1 AND ITS OBSERVATION OF CRAB PULSAR

Beijing TIANTI WULI XUEBAO [ACTA ASTROPHYSICA SINICA] in Chinese Vol 7 No 2, Apr 87 pp 140-146

[English abstract of article by Dai Changjiang [2071 7022 3068], et al., of the Institute of High Energy Physics, Chinese Academy of Sciences]

[Text] A hard X-ray phoswich telescope, HAPI-1, is described that has been designed to make observations of high flying balloons. The telescope is comprised of a 145 cm primary crystal of 5 mm thick CsI (Tl) actively shielded over the lower 2 steradians by a 5 cm thick NaI (Tl) crystal and has a field of view of approximately 4° HWHM determined by a graded shield and collimator. The scintillation pulses originating in CsI and NaI crystals are distinguished by pulse shape discrimination. All sub-systems of the telescope are described. The Crab pulsar was observed by HAPI-1 during a balloon flight on 23 May 1984 in the energy range of 20 to 200 keV, and the observation results are presented.



Cross Section view of HAPI-1 detector

9717
CSO: 4009/53

SUCCESSFUL OBSERVATION OF MOLECULAR RADIO SPECTRAL LINES BY DIGITAL AUTOCORRELATION SPECTROMETER

Beijing TIANTI WULI XUEBAO [ACTA ASTROPHYSICA SINICA] in Chinese Vol 7 No 2, Apr 87 pp 162-164

[English abstract of article by Zhou Tijian [0719 7555 0256], et al., of the Department of Geophysics, Beijing University]

[Text] The authors made a prototype digital autocorrelation spectrometer which was used in a successful radio spectral line observation of hydroxyl at the 18 cm band toward Halley's Comet and five master sources. The observation was done cooperatively in March and April 1986 by Beijing University, Shanghai Observatory and the 39th Institute of the Ministry of Electronics Industry. This observation was the only radio spectral line observation toward Halley's Comet in China and the first radio spectral line observation toward molecular clouds.

9717
CSO: 4009/53

INCREASED FUNDING FOR WATER POLLUTION CONTROL

HK150802 Beijing CHINA DAILY in English 15 May 87 p 1

[By Staff Reporter Chen Guanfeng]

[Text] China will invest 12.5 billion yuan in preventing water pollution in the next few years, it was learned yesterday.

The money will mainly go to improve the quality of the water in the country's seven major rivers, including the Yangtze, the Yellow, the Zhujiang, the Huaihe and the Haihe.

Waste water disposal plants will be set up in all major cities bordering these rivers to prevent the discharge of waste water, which is expected to amount to 33.8 billion cubic metres in 1990.

The effort is expected to ease the serious water shortage caused by pollution and over use of underground water supplies in the country's major cities including Beijing, Shanghai and Guangzhou. In all the cities along the rivers the drinking water is far below state standards.

The programme is part of a 5-year environmental protection plan compiled by the State Planning Commission and the Environmental Protection Committee under the State Council.

Under the plan, the government will invest 33 billion yuan in environmental protection projects. They will cover industrial pollution prevention, water resources protection nationwide, overall environmental improvements in urban areas, and maintaining ecological balance in the country.

Other items in the plan include the training of more than 20,000 environmental portection workers, setting up a national environmental protection network, and formulating laws and regulations.

The plan also includes detailed measures and specific targets in the country's environmental protection efforts in the next few years.

Legal measures will include laws on environmental and wildlife protection, air pollution prevention, noise control, solid wastes management and nuclear pollution prevention.

All these efforts are intended to stop further pollution, which the plan says is already "seriously affecting the development of the national economy and the health of the people."

Air pollution, the plan says, is a very serious problem, with the dust content in the air in all Chinese cities exceeding state-prescribed limits.

Acid rains are increasing in some southern cities, more and more soil and crops are polluted due to the use of undisposed waste water for irrigation, and increasing amount of solid wastes are discharged indiscreetly everywhere to pollute the air and water.

Moreover, it says, noise pollution is becoming even graver in urban areas as the number of the vehicles soars.

"All these pose a serious threat to environment and the human body," the plan says.

/12232
CSO: 4010/47

NEW 'SUPER HIGH-TEMPERATURE ALLOY STEEL' INVENTED

OW171256 Beijing XINHUA in English 1207 GMT 17 May 87

[Text] Shenyang, 17 May (XINHUA)--The Institute of Metals of the CAS has recently succeeded in making a kind of super high-temperature alloy steel that can be worked at a temperature of over 1,200 degrees centigrade, according to the CAS.

The alloy steel is claimed to be the first in the world to resist such a high temperature.

The material, used for making aeroengines, is usually obtained by using super pure iron with extremely low contents of sulphur, phosphate and foreign matters. In the past, the institute obtained such super pure iron, but owing to the complicated purification processes and serious pollution, it was hard to be applied in large scaled production.

Recently, the institute carried out a large scaled industrial experiment at the Shanghai No 5 Steelworks by using the iron ore produced in the Nanfen Overcast Iron Mine of the Benxi Iron and Steel Company in northeast China, mixed with the super pure iron obtained by the wet process. The alloy steel obtained can resist a temperature 40 to 100 degrees higher than those formerly made.

/12232
CSO: 4010/47

CAS SUCCEEDS IN PRODUCING RARE EARTH SUPERCONDUCTOR

OW141354 Beijing XINHUA in English 1336 GMT 14 May 87

[Text] Hefei, 14 May (XINHUA)--Researchers from the Chinese Academy of Sciences have cooled eight groups of compounds to a temperature above 90 kelvin--minus 183 degrees centigrate--and monitored superconductivity--a phenomenon of a material losing all its electrical resistance.

This was achieved by a research team at the academy, which used "heave rare earth" elements.

The researchers used materials such as yttrium, strontium, dysprosium, gadolinium, thulium, ytterbium, erbium and holmium mixed with barium, copper and oxygen, Zhang Qirui, head of the team, told XINHUA today.

On 25 March, they first succeeded in producing the superconductor at a temperature of 92 kelvin (minus 181 degrees centigrade), with a compound of barium, yttrium, copper and oxygen.

"The highest temperature we have achieved was with a compound of barium, gadolinium, copper and oxygen, which was cooled to 92.5 kelvin 10 April," Zhang said.

Magnetic susceptibility also proved that these materials work well in magnetic fields.

"The significance of these discoveries is that the compound can be abstracted from rare earths which are abundant in China," the professor pointed out.

The university has also produced a kind of superconductor film with chemical methods, for which it has applied for a patent.

/12232
CSO: 4010/47

FUJIAN STRUCTURE OF MATTER INSTITUTE MAKES BREAKTHROUGH

Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 19 Feb 87 p 4

[Article: "Chinese Academy of Science's Fujian Institute on the Structure of Matter's Successes Are Great; Last Year 11 Crystal Materials Entered International Market"]

[Text] Last year, 8 scientific and technical results of the Chinese Academy of Science's [CAS] Fujian Institute On The Structure of Matter won National Science and Technology Advancement Prizes, and 11 advanced crystal materials entered the international market. In addition 2 major scientific research results passed CAS appraisal.

The non-linear laser crystal material barium metaboric acid which was successfully researched independently by the Fujian Institute On The Structure of Matter was one of three projects which won a National Top Science and Technology Advanced Prize. This laser crystal material was praised by foreign scientists as a high grade "Chinese brand" optical crystals for its superior non-linear optical characteristics, high chemical stability and laser destructive threshold value, and displays unequaled competitive ability in international high tech products market. NASA has decided that in 1990, barium metaboric acid chips will be placed in the space laboratory to carry out scientific experiments. The research on Chinese medicine's small-pox powdered protein space-filling which was carried out by this institute in cooperation with the Shanghai Biophysics Institute and the Shanghai Organic Chemistry Institute achieved advanced world levels. This is another research area for this institute since the synthesis of insulin and RNA.

Another project which passed appraisal, the development of a new laser crystal material aluminum-noedymium boric acid, was praised as one of the 10 major scientific and technical results of the CAS for 1986.

In clinical tests in the Changzheng Hospital in Shanghai, the small-scale high power YAP continuous laser medical treatment machine developed by this institute proved it has special curative effects on such ailments as esophageal cancer and broken bones. The Fujian Institute On the Structure of Matter was established in 1960 and currently has over 200 scientific researchers with technical titles above mid-rank, and over 70 high level researchers. Since its creation it has obtained over 140 scientific and technical results of which over 30 are major results.

FUTURE OF RESEARCH INSTITUTES PONDERED

Beijing KEJI RIBAO in Chinese 1 Feb 87 p 2

[Article by reporter Han Zhongkun [7281 6988 2492]: "Whither Research Institutes?; Looking At the Readjustment of Scientific Research Organizational Structure from the Perspective of Chongqing's Joint Research and Production"]

[Text] This reporter recently learned from the Chongqing City Science Commission that the alliance of scientific research, education and production in Chongqing, China's southwestern economic center, is developing from a casual towards a close and even integrated direction, the developmental outline of the organizational structure of scientific research and the social position of the research institute are now becoming clear.

The Time Is Ripe

Chongqing is a comprehensive pilot city for system reorganization. The joint research and production pilot project was early and developed very rapidly. In 1985, 13 research institutes under the city established 42 joint research and production entities with relevant units inside and outside the city. In 1986 it was expanded to 19 municipal research institutes which organized 74 joint research and production entities. Currently, there are 218 joint research and production entities of various forms and at various levels in the city. Joint research and production actually is a one-time division and reorganization, and it breaks through the original vertical and horizontal ties. Beginning a new, in the process of socialist selection according to the laws of commodity economic development and science and technology development, joint research and production has pointed out the direction for scientific research organizational structure and made preparations in ideology and organization.

From what reporters saw these preparations were manifested in two areas:

The first area is joint research and production. Its success and its dominant position is felt by both research and production and it is inevitable that it will move towards closer combination or even integration.

The Chongqing Machine Institute is an institute under the Chongqing Machine Bureau. In the past, under vertical jurisdiction, it could not find any research mission laterally, as a result it almost sustained losses and was transformed without much vigor; after turning towards society, a large state-run plant with machinery of an unequaled technical depth was developed, and special machinery was developed but could not be produced in large quantities. Thus they were hard up for funds, and were caught in a dilemma. The Chongqing Jiagbei Machine Factory is the country's largest plant producing centrifugal machines. It had been moved from Guangzhou, and although its products were selling well, since it was an out-of-the-way place, it was hard to keep good talent. Thus technical forces were weak and it was difficult to up date products. The institute and the plant each had its problems and needs. The director of the institute became the factory head, and the Jiangbei factory head became the institute director. Together, these two experienced persons found a common language and decided to start a centrifugal machine group corporation with personnel, finance and materiel under unified management. Although they ran into obstacles later, the joint trend was accomplished. On the basis of the Jiangbei Plant's demands, the Machinery Institute found the reason why the rotating arm bearings of the Jiangbei Factory's centrifuges were easily damaged, provided the Machinery Institute with expenses, components and product testing conditions. Both sides coordinated by tacit agreement, complemented each other, and are developing towards a joint-stock company.

The second aspect is that in the past few years many contradictions, problems, and difficulties have appeared in joint research and production. People must take into account the context of these contradictions and whether they ought to understand and resolve these contradictions from a higher and more profound level.

When reporters were visiting the Chongqing institute unit and the university they saw the following: 1. scientific research departments generally took the long view, stressed applied research and developmental research, recognized that otherwise there was no reserve strength but that the enterprise should more look at the present, demand "short, level, fast" projects with greater effectiveness and benefits, demand ready-made technology for transfer, and are unwilling to pay expenses for long-term research. 2) In recent years, the state had invested some research institutes toward the enterprises, but the enterprises would prefer to invest these funds in plant-run research agencies or even convert them to other expenses and are unwilling to invest them in society. 3) Allocation of joint research and production benefits has always been a problem; the benefits as calculated by the research institute are larger but the accounting numbers of the enterprise are smaller so that some research units must send financial affairs personnel to the enterprise to participate in cost accounting. 4) For a long time the advanced technology and equipment imported from abroad has frequently been kept secret so that we have no way to digest it nor are we willing for other research units to participate in digesting it. 5) casual alliance has obviously promoted flow of intelligence and personnel,

but a lack of talent on the industrial front line has not yet been fundamentally resolved.

These phenomena suggest that changing the situation in which research and production are isolated is an objective demand presented by history and is an important step in the reform of the science and technology system. The time is ripe to resolve this problem.

Some Development Trends

The close alliance of research and production in Chongqing City is now developing in the following directions:

Research institutes and enterprises have merged to form a single entity either to create a new enterprise jointly or to jointly form a new technological and economic development entity. In addition to the examples cited above, there is also the Chongqing Package Printing Industry and Trade Joint Company made up of 119 packaging industries, research institutes and institutions of higher learning in 5 provinces and 8 cities of the southwest.

The research institutes and enterprises carry out technological cooperation or joint management and jointly develop new products and new technologies. The Chongqing Pharmaceutical Industry Research Institute developed a new drug--leinitiding [7191 1441 2583 0002]--for treating diseases of the digestive tract, which sells well internationally, but it lacks the manufacturing conditions; the Dongfanghong Reagent Plant has the technological conditions, but lacks the research capability. Both sides cooperated: the reagent plant made the monomers and the institute added the synthesis and this year the value of production has reached 10 million yuan with profits of 3 million yuan.

Some research institutes have become industrial development centers. The Chongqing Silicate Institute has a group of high level scientific researchers who can take on state scientific research projects; it produced scientific research results on over 20 projects which are now being disseminated to a group of plants in 8 cities in China; it has dozens of advanced measurement devices and is empowered by the Ministry of Light Industry as the adjudicating unit for performance testing of enamel products of the south-central, southwest, and northwest region; it trained 236 scientific and technical personnel with educations above technical school level from 79 plants in 25 provinces and cities and actually has become the technological development center, product testing center and technological training center for the southwest enamel industry.

Some scientific research institutes are becoming scientific research enterprises. The Chongqing Steel Research Institute developed a corrosion-resistant steel, and can produce fine, thin, and small special corrosion-resistant steel material. Intermediate testing equipment from iron-smelting, steel-smelting, and cogging to finished material is basically complete, and last year they cancelled out facilities expenses.

In short, readjustment of organizational structure is gradually beginning to take shape.

Readjustment Is a Process

Although the outline of the readjustment of scientific research organization structure is gradually becoming clear, there are still big difficulties and obstacles to really implementing it, and the task of establishing new ideas is enormous.

From this reporter's observations, whatever aspects, be it scientific research, production or the offices in charge there was difficult intellectual work to do. In terms of the scientific research institutes, most were bent on being "leads", "centers", striving for independence and self-perfection, but very few have the spiritual preparation for amalgamation, combination, or taking the initiative to accept socialist selection. As far as the enterprises were concerned, they still lacked the desire for the inherent motive force of science and technology. Enterprise groups and enterprises masses are developing and are bound gradually to demand participation and association with scientific research units, but at present, their primary attention is focused on developing sub-factories and spreading products, and they lack the sense of urgency about establishing strong science and technology development units, and developing second and third generation products. As far as the offices in charge are concerned, there seems to be a tendency to be unwilling to begin or even strengthen control. In the integration process of some institutes and plants in Chongqing, "administrative grannies" got in the way. They said that it used to be to serve a bureau and now wasn't it serving a factory? Basically they have not escaped an outdated style of thinking.

Thus, many comrades believe that alliance is an historical trend and also an historical process. That is, promoting understanding on all sides and obtaining common knowledge, creating conditions of cooperation, and exploring the experience of cooperation is a process. Administrative measures can promote this process but it cannot replace it. The correct attitude should be, actively guide, vigorously promote, ripen one, resolve one, adopt whatever type that conforms with the actual situation, and don't do everything the same way.

8226/9190
CSO: 4008/2073

CAS OFFICIALS MEET WITH 15 SCIENCE SUPERSTARS

Beijing RENMIN RIBAO in Chinese 29 Jan 87 p 2

[Article by reporter Wang Xiyuan [3769 3305 0337]]

[Text] On the afternoon of 28 January, Lu Jiaxi, former president of the Chinese Academy of Sciences [CAS] and former vice-president Yan Dongsheng and current president, Zhou Guangzhao and vice-presidents Sun Honglie and Teng Teng met in Beijing with 15 researchers who had made outstanding achievements in scientific research. In a atmosphere of celebration and congratulation everyone talked about their feelings and future plans.

First of all, President Zhou wished everyone a happy new year. In his talk he said that this year is the second year of the Seventh Five-Year Plan and the CAS is facing two most important tasks: one is continuing to carry out the reform; the second is maintaining the four basic principles and opposing bourgeois liberalization. He said that the aim of reforming the system of science and technology is to mobilize the initiative of scientists and technicians, mobilize and organize all the CAS's primary scientific and technological forces to serve economic construction, and at the same time maintain a crack force to carry out basic research.

Zhou Guangzhao said that although the CAS's old leaders Comrades Jiaxi and Dongsheng were retiring, the new party organization had decided to ask these two old scientists to be consultants to the CAS. In the past they did a great deal of work in leading reform and scientific research in the CAS and laid an excellent foundation for future work. He hopes that in the future Comrades Jiaxi and Dongshen will continue to make contributions to the development of the CAS.

Lu Jiaxi said with delight, that on New Year's Eve we welcome in the year of the Rabbit. I was born in the year of the rabbit and I am now 71.2 years old. In the past two years the older I get the more I feel that my energy and strength are not up to it, therefore, more than once I have proposed that the leadership of the CAS should change, that I step down and let younger comrades take over. This arrangement, I should say,

fires me up, so that I can freely engage in some research, write my memoirs, and made some additional contriutions to the development of the CAS. He said, I would like to modify a saying of the ancient Zengzi to spur myself on: "Is it disloyal to plan for the Four Modernizations?"

Yan Dongsheng said, I am also 69 years old, and proceeding from the work of the entire CAS, I feel that I should step down. This realignment of the CAS's leadership has been discussed for a long time. I hope that the new leadership and the comrades of the CAS will work together with one heart and climb higher peaks.

The other comrades who attended the meeting also made short speeches. They were, Qian Shouyi [6929 1108 2496] who was one of the primary completers of the "Geological Survey and Evaluation of South China Sea Beibuwan-Wei 11-1 Region Engineering" project, Ye Changming [0673 1603 2494], one of the primary completers of "Research on Organic Pollutants in Beijing-Tianjin Area Water", Tan Jian'an [6223 6015 1344] one of the primary completers of "Discovery of China's Low Selenium Zones and the Causes of Keshan Disease and Kaschin-Beck Disease" project, Gu Erwang [7357 1422 2489], one of the primary completers of the "200MB Disc Servodisk kehua [0466 0439] Device and 200MB Changeable Disk Sets" project, Zhang Dengbo [1728 3397 3134], one of the primary completers of "Single Channel, Single Polarized Compound Hole Measurement Radar" project, Zhang Qixia [1728 3828 7209], one of the primary completers of "Mathematical Software Library" project, Jiang Yanling [5592 1693 7881], mainstay of the "Ring Accelerator Porjedt, Zhang Guanquan [1728 7070 3123], primary completer of the "A Numerical Seismic Exploration Method" project, Liu Changfa [0491 7022 4099], primary completer of "Electron Beam Digital Image-Recording and Conversion System" project, Wang Lan [3769 5695], one of the first developers of "FH-1 Type Humic Acid Resin Ester", Zhao Zhongzian [6392 1813 6343], primary discoverer of superconductors which have the highest critical temperatures in the world to date, Huang Shouling [7806 1108 7881], "molecular Beam Laser Fragmentation Product Spectrometer", Chen Dequan [7115 1795 3123] researcher of the "Daqing Oil Field Planning Scheme Priority Selection", Zeng Qingcun [2582 1987 1317], Director of the Atmospheric Institute who completed "Design and Trial Calculation of a Multi-level Atmospheric Environment Model Dynamic Framework", and Wang Rusong [3769 1172 2646], who has outstanding achievements in the area of urban environment and ecological systems research.

8226/9190
CSO: 4008/2073

TECHNOLOGY SITUATION IN LARGE ENTERPRISES

Beijing KEJI RIBAO in Chinese 19 Jan 87 p 3

[Report by Yan Zulin [6768 4371 2651]: "Some Problems with Promoting Technical Advances in Medium to Large Enterprises"]

[Text] There are currently 340,000 industrial enterprises in this country, among which 5,800 are medium to large enterprises, or 1.65 percent of the total number of industrial enterprises. However, they account for 65.7 percent of fixed assets, 47.1 percent of industrial output value, and 66 percent of tax revenues. Some 1,300 large-scale enterprises among them account for 44 percent of fixed assets, 28.6 percent of industrial output value, and 39 percent of tax revenues. Therefore, doing a good job with large scale enterprises will be a key in achieving the goal by which to quadruple agricultural and industrial output value by century's end.

China is a developing country, and increases in external factors such as funding and manpower (especially qualified manpower) are limited, and we should primarily rely upon advances in science and technology and the means by which we expand and reproduce internally. With the deepening development of the restructuring of the economic system, competition is becoming more and more fierce and markets are changing drastically. Competition is actually a competition of technologies and intellectual competition. Only by relying on advances in science and technology can we ensure that enterprises will constantly improve their economic results and capacities for competition; and only in that way can contingencies be met smoothly in fierce competition, can we march bravely ahead, and can we find ourselves in invincible positions.

According to statistics from the State Economic Commission, there are at present only 15 percent of medium to large enterprises that are being run energetically; there have been changes in 65 percent of medium to large enterprises, but vigor is still insufficient; 20 percent of medium to large enterprises basically have no vitality. Therefore, it is extremely necessary to explore the problems concerning the promotion of scientific and technical advances for medium to large enterprises and the strengthening of capacities for technology absorption and development. The suggestions proposed in this article are for reference in research.

1. Enterprises should internally work to establish research and development structures.

Medium to large enterprises in developed countries generally have their own research and development structures, which constitute 90 percent of the research and development structures in those countries, where the scientists and technicians therein and the research funds thereof are about 70 percent of those of the entire country, and where the research and development capacities are quite strong. Conditions in this country are exactly opposite. According to statistics, by the end of 1984 there were 9,977 research and development organizations affiliated with departments at the prefectural and municipal levels and above throughout the country, of which more than 4,700 were independent research institutes, many institutes were part of higher educational institutions, and there were not many research and development organizations run by enterprises. To use the machinery industry as an example, there were more than 270 large scale enterprises, more than 1,000 medium size enterprises, but only some 130 enterprises that had institutes.

By establishing research and development structures, enterprises can promptly turn over topics in urgent need of resolution from production to research and development structures, while research and development structures can obtain research and development expenses from enterprises. Research achievements can also be promptly applied in production, which consequently allows enterprises to change from production models to science research and production operations. This way fundamentally resolves the malpractice of the "two skins" that are science research and production. When enterprises have research and development structures, they then have the capacity for technology absorption and development, and can continue to promote scientific and technical advances, to turn out new products, and consequently to ensure an invincible position in competition.

2. Enhance the ability of the enterprise to bring together scientists and technicians.

There are currently very few scientists and technicians affiliated with enterprises in this country, and the capacity for technology development is quite weak. According to statistics, the proportions of science and technology personnel to total staff at several major enterprises at the end of 1985 were: 4.1 percent in metallurgy, 5 percent in chemical engineering, and 6.3 percent in machinery. In addition, for various reasons, the enthusiasm of this relatively small number of scientists and technicians has yet to be fully aroused. A minority of enterprises have scientists and technicians seeking to transfer or be dismissed, which gives rise to the phenomenon of an outflow of skilled personnel. Faced with this fact, some preferential policies should be formulated to improve the remuneration for scientists and technicians in enterprises, to improve their working and living conditions, to strengthen the capacity of enterprises to bring scientists and technicians together, and to create excellent conditions through which to bring in skilled personnel.

3. Enhance the research and development funds for enterprises

According to statistics from pertinent sectors, the ratios of research and development funding for metallurgy, chemical engineering, machinery, and electronics enterprises in this country to their current total output values are 0.5 percent, 1.1 percent, 1 percent, and 5.5 percent, respectively, far lower than levels for similar enterprises in developed countries. Worth mentioning is that although in these past years the state has had difficulties, some enterprises have still spent large sums of foreign exchange to bring in unassembled parts to construct facilities or have bought entire sets of equipment, but have been unwilling to spend money for technology or to develop technology.

Because they have lacked funds, enterprises have no strength to absorb and develop advanced technologies, their products do not have a capacity for competition, and the enterprises are not vigorous; since the enterprises are not vigorous, the funds are even tighter, all of which have led to vicious cycles. If we are to change this situation, in addition to extracting the internal potentials of enterprises, we must provide enterprises with some preferential policies, including a further streamlining of administration and release of authority, a reduction of enterprise responsibilities, a planned, gradual improvement in the depreciation rate for equipment, as well as progressive retention by the enterprise of the entire depreciation fund for use in technology transformation and technology development. At the same time, we should continue to implement the policy regarding the reduction or exemption from taxes on new products, and also a certain proportion could be retained before taxes for a technology development fund, especially for the income derived by research and production associations from developing new products. Banks should increase grants of science and technology low interest loans to develop risk investment ventures and to support enterprise technology development.

4. Formulate policies to hasten product renewal and updating.

Why is it that some enterprises are not enthusiastic about establishing research development structures, do not respect science and technology personnel, and are not interested in bringing in technology and skilled personnel? One important factor is in the fact that even though their products have remained unchanged for decades, they are still able to sell them, and even some among their products have been evaluated as "top-quality name-brand" products. Therefore, enterprises have not been threatened by the obsolescence of old products and therefore quite naturally feel no need to develop new products. Some of the policies we are currently implementing are actually serving to safeguard backwardness.

To hasten the obsolescence of old (backward) products and to promote the development of new (advanced) products, we must use economic means. On the one hand, implement a tax on backward products, and put a progressive tax into effect to remove any consideration of profit and to hasten the process of obsolescence. On the other hand, this will subsidize enterprises producing advanced products. Top quality new products realize top quality premium pricing. Subsidy funds can come from the taxes generated from the backward

products tax. In addition, this will link the incomes from technology development and technology transformation together with the personal benefits to enterprise staff, and will as well treat technical advancement as an important index for examining enterprises and enterprise leadership. This would consequently form an economic and social environment that controls backward commodity production and supports the constant appearance of advanced new products.

12586
CSO: 4008/2060

INTERNATIONAL ACTIVITIES IN AVIATION MAINTENANCE REPORTED

Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 4 Feb 87 p 4

[Report by Zhu Hao [2612 3185]: "Our Air Force Maintenance Technology Enters the International Marketplace"]

[Text] Air Force aviation maintenance technologies from this country have entered the international marketplace. Currently, the Air Force aviation maintenance system has established venture connections with aviation sectors from more than 30 nations and regions of the world, and has begun to win an international reputation.

The Air Force in this country has several aviation maintenance plants with excellent equipment and advanced testing, maintenance, development, and production means, with an annual capacity for aircraft engine maintenance of nearly 10,000 units. Since the streamlining of the units, aviation maintenance departments affiliated with the Air Force, under the premise of ensuring ground crew maintenance and research tasking of Air Force units, are using surplus technical capacity and equipment to actively develop an external aviation maintenance trade, and have established venture relations with some foreign aviation sectors. The projects include 10 service operations activities such as: assuming responsibilities for maintenance, installation, and replacement of aircraft, aviation engines and their parts, and instrumentation and equipment for foreign customers; exporting of aviation maintenance specialty tools, inspection and testing instruments, equipment, and parts; taking on import processing from plans, from samples, and from materials, as well as assembly of components; contracting for the overall construction of large, medium, and remote maintenance plants and for the construction of single-item production lines; and providing aviation technology materials, as well as personnel training and the transfer of rights to special technologies.

It is said that for more than 2 years the Air Force has provided aviation maintenance services for more than 60 foreign customers, which has earned a sum of foreign currency for the state. In addition, it has developed jointly funded operations, cooperative production, and compensation trade ventures with aviation sectors abroad.

According to statements by responsible persons in Air Force aviation maintenance departments, there are currently many countries in the world where the levels of aviation equipment and maintenance are equivalent to our own. There is only a small technology gap to bridge when using the aviation maintenance technologies, experience, and equipment of this country, and the application performance has been good, so that service is easily accepted. It may be foreseen that the future for Air Force aviation maintenance technology in the world will become ever broader.

12586
CSO: 4008/2060

OVERVIEW OF HEAT TREATMENT TECHNOLOGY IN CHINA PRESENTED

Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 1, Jan 87 pp 5-9

[Article by Dong Yiliang [5516 0001 5328], deputy secretary of the Heat Treatment Specialty Association of the China Machine-Building Processing Association: "Forecast of the Development of Heat Treatment Technology in China in the Near Future"]

[Text] Taking a look ahead at the near-term development of China's heat treatment technology can play a policy-setting and guiding role for overall design and planning of technological development for the future, for leaders and for management, scientific research, design, teaching and production departments, and in investment, technological reform, setting up specialized production, determining research directions, selecting import goals, organizing promotion of new technology and training of personnel. Below I will present some immature views on how to analyze near-term development of heat treatment technology.

I. Projecting Development Directions From China's Present Circumstances

1. Basic Situation

First of all, we should analyze the present situation in China's heat treatment industry, primarily productive capacity and technological level, including personnel, equipment, agencies, output, consumption, labor productivity, and environmental protection. This is the foundation for forecasting development. Next, we should carry out an analysis of the present state and levels of the industry abroad and compare China with it. For example, processing technology, equipment, auxiliary devices, control and monitoring, technological processing materials, auxiliary materials, specialized production, control of the three wastes, product quality and standards, and quality of production management and policy and personnel, finding the gaps in these areas and determining goals, we can accurately forecast how they will develop in the near term.

2. Development Goals and Policies

According to the state science and technology development plans, our goal is that heat treatment technology should, in the last part of the Seventh 5-Year

Plan, catch up with the level of the industrially advanced countries abroad in the late seventies and early eighties.

To realize these goals, we should formulate correct technology policy and clarify what we are developing, encouraging, promoting and spurring on and what we are restricting and weeding out.

3. Key Tasks

Under the guidance of correct struggle goals and technology development policy, I feel that we should formulate heat treatment development projects on the basis of the overall development plan of the nation's entire machine-building industry and make them a part of overall machine-building industry development. For example, development of large-scale equipment sets, development of important products, development of important basic components, basic technology research, major industrial testing, major new technology promotion, formulating and revising important standards, adopting international standards, importing technology, the absorption and recreation of imported technology, development of scientific research agencies and scientific research undertakings, building and training employee ranks, building a scientific research and testing base, matching and coordination which must be supplied by fraternal departments (such as metallurgy, petrochemical, chemical industry), and specialized readjustment and reorganization. We should comply with these development missions from the perspective of heat treatment specialization.

Of course, we should adopt effective measures in administration and economics to realize the struggle goals and carry out the key development tasks.

II. Guiding Thinking of Formulating Development Plans

1. Implement the State's General Guiding Principles

The general guiding principle of "maintain invigorating the economy internally and open up externally" and the guiding principle of "economic construction must rely on science and technology and science and technology must be directed towards economic construction" are general state guiding principles which must be observed. To implement the strategic goals of the machine-building industry's Seventh 5-Year Plan, i.e., by 1990 to make half of the key machine products reach the level of international industrially advanced countries of the late seventies and early eighties, constantly expand exports and create foreign exchange capabilities. The development of heat treatment industry must obey these demands and shoulder a heavy burden.

2. Judged by the Key Position and Role of the Machine-Building Industry, We Must Promote Rapid Development of Heat Treatment Technology

The machine-building industry is taking on an enormous task of providing technological equipment for the technological reform and key construction of various sectors of the national economy and 10 years before the end of this century (i.e., 1990) must lay a good foundation, accumulate strength, create conditions and advance the technological reform of the machine-building industry itself.

In the past, the Soviet Union called machine-building industry the "heart of heavy industry" and now calls it "the foundation of the technological reform of the national economy," Japan calls heavy industry the "forerunner department for economic take-off." The decisive role of the machine-building industry in the advance of science and technology is unquestionable. The primary indicators of modern technological progress, electrification, mechanization, automation, computerization, and informationization all rely on the material and technological foundation provided by the machine-building industry. The improvement of the structure of social production, economizing on energy and materials, and improving economic benefits also all rely on even more advanced mechanical equipment supplied by the machine-building industry. Converting science and technology results into productive forces also relies on mechanical equipment serving as tools and bridges.

Heat treatment, which is one of the fundamental processes of machine building plays a key role in guaranteeing the inherent quality of machine spare parts and lengthening the useful life of machines. At the same time, heat treatment also fully exploits the potential of the metal material and is an effective way to save on using materials. Thus, if technological advance is extremely urgent and promoting the heat treatment industry cannot take off in the Seventh 5-Year Plan, it will delay the lead period of the machine-building industry and influence the development of the entire national economy.

3. From the Perspective of the Situation in the Machine-Building Industry, Centering on the General Goals, Improve Economic Benefits and Service To Improve Quality, Level, and Varieties of Products in the Machine-Building Industry

At present, the main problem of the machine-building industry is still that quality is low, varieties of products are few, level is low, and economic benefits are not high.

A. Lack of quality and low technical level are primarily manifested in the fact that only 10 percent of the machine-building industry's products really achieve the levels of the late seventies and early eighties abroad. For a long time, manufacturing departments have not given serious consideration to the needs of the customer and technological progress, and the customer lacked confidence in the mechanical and electrical products; from top to bottom, no strict quality control and warranty system was established, which was far from meeting the needs of developing product varieties and improving quality. Lack of quality and poor performance is also prominently apparent in that maintenance of precision is lacking, performance is unstable and useful life is short. For example, for a small-scale jig borer, position precision of 2 μm is international level, but if the main shaft sleeve and guide cannot tolerate the friction, the precision is lost very rapidly. Abroad this can generally be maintained for over 10 years. Or, for another example, the Liberation brand automobiles' major overhaul mileage is 100-150 thousand km, for diesel trucks it is 200 thousand km; but for foreign gasoline powered automobiles it is about 300 thousand km, for diesel vehicles 500 thousand km or even 800 thousand km. The operation rate of foreign mechanical excavators is 85-95 percent, for hydraulic-type excavators it is 80-90 percent, but for Chinese

ones it is only 50 percent; foreign bulldozers the initial period without a breakdown is 2,500 hrs, but for the domestic model it is 300 hrs; the life of a domestically manufactured steel-rolling machine bearing is 500-600 thousand tons for steel rolling and 2-3 million tons abroad. These must be rapidly resolved.

B. That varieties of products are few is currently evident primarily in the fact that there are about 50,000 Ministry of Machine-Building Industry (guikou) electromechanical products, but in the Soviet Union there are 130,000 and in the United States, Japan, and Western Europe the varieties of products are even more numerous, as in the table below.

Important Machine Products of Several Countries
(Varieties)

Product	China	USSR	Japan	United States
Cutting machine tools	1,560	2,000	3,000	
Forging equipment	430	1,500		
Bearings	11,000		30,000	
Trucks	120	200		500
Hydraulics	327			1,194

Ability to develop new products is weak. In terms of machine tools, for example, from 1978 to 1981 the rate of increase of new products was only 140 product varieties per year, but in the Soviet Union the annual increase in 1971 to 1979 was 340 product varieties. In addition, China's new product test manufacturing cycle is 1-2 years, but abroad it is 6-9 months.

C. The deficiency in economic benefits is evident from the fact that labor productivity is low, fixed capital output rate is low, material consumption output value rate is low, the floating capital cycle is long and the foreign exchange creation ratio is low.

It can be seen that for a long time for the machine-building industry the opportune time of the strategic goal of "three raises and one improve" has been a disadvantage and the development of heat treatment technology must make a contribution closely centered on this goal.

4. Development of Research Work

Scientific research work should proceed from the fundamental aim of improving product quality and turn in the direction of production, place special emphasis on development, strengthen the foundation, and enrich savings.

Currently, there are many problems of quality in production enterprises but our scientific research and implementation proceeds mostly from scientific development and searching for a production and application target frequently imposes on upper echelons the demand to sign a contract or restrains by results which have been approved or won prizes but which have limited directionality, they are unable to create the urgency for urgent production, to help the producers and customers over their difficulties, we end up with this present situation in China of "high level research topics and backward production technology." Thus, we definitely should engage in in-depth market and customer surveys so that scientific research work will have a target to shoot at. In addition, in recent years, with the reform of science and technology and science and technology results entering the market as products, after the technical results are accepted they are pigeonholed and although there have been changes, the promotion of technical results, i.e., the tasks of shifting from laboratories to production, shifting from coastal cities to interior and border markets, and shifting from the military industry sector to the civilian sector is still far from enough. The proportion of technological results which have been converted into productive forces is low and there is still the problem that the rate and range of promotion is neither rapid nor broad. Of course, due to factors in the system and specific policies, relatively more enterprises lack pressure, impetus and strength for technical advance, do not give serious consideration to science and technology results, the rapid aging of production technology, production equipment and products still exists, substandard products still leave the factory on their way to society, thus scientific research work definitely should take a clear stand and make improving product quality the fundamental aim and put orientation towards production and placing emphasis on development in first place. Doing this is not to deny basic research and technological savings; to the contrary, only in this way can we have correct basic research and can the technological savings direction have a firm base.

III. Near-Term Heat Treatment Technology Development

A. Key Problems Which Should Be Resolved Now

The development of heat treatment technology should break through key backward technologies and resolve problems using complete technologies. For example:

1. The level of conventional heat-treatment processing is low. Almost all heat treatment production departments involve such conventional processing as hardening, tempering, annealing, normalizing, carburization, and nitridation. The quality of similar steel and parts after using similar processing treatment is uneven. The causative factors of this phenomenon are many and varied, but the most basic causes are in the lack of carrying out strict scientific testing under special environment and conditions, the processing standards and parameters are selected without care so it is very difficult to achieve the anticipated effect. Thus, great effort should be made to improve the level of conventional processing to make breakthroughs in uncovering potential, innovation and reform.

2. Development of Nonoxidized and Denitrified Heat Treatment Technology

Controlled atmospheric heat treatment and vacuum heat treatment are important indicators of progress in heat treatment technology. Currently, there are only 200 controlled atmosphere furnaces in China, and because of the difficulty in supply of raw material gas, they have been bogged down over the past 10 and more years. The various types of nitrogen base atmospheres which were under development to get out of this predicament got under way not long ago, an easy drop injection-type nitridation generally has the problem of improving control precision. In the past few years heat treatment in China has made strong progress and now encompasses over 200 vacuum devices and the application results have been affirmed. Calculated on the basis of the makeup of equipment, controlled atmosphere and vacuum heat-treatment devices account for only about 1 percent. Abroad, in the industrially developed countries it is 40-50 percent. Induction heating equipment which has low oxidation, low energy consumption, and is easy to mechanize and automate makes up only about 8 percent, while abroad it is 23 percent. Seventy to 80 percent of existing equipment is still heating equipment in an oxidized medium from the forties and fifties. The no-load losses of this type of equipment are large, the furnace temperatures are uneven and the air-tight performance is poor. Equipment is a necessary means for carrying out processing and the fact that the rate of heat treatment equipment updating is slow is an important reason why China's heat treatment production is backwards.

3. Processing and Quality Standards Are Backward

There are 324 heat treatment standards for ISO and 13 nations, but China has only 8 national heat treatment indicators and the Ministry of Machine Building has only 34 standards. It is true that the equivalent of the task of directly adopting international standards and the standards of the industrially advanced countries is arduous, and the phenomenon that internal enterprise control standards are lower than ministry standards, and ministry standards are lower than national standards must be turned around.

4. Level of Monitoring and Control Is Low

Currently the instruments and meters used for control of processing parameters and monitoring of quality perform poorly and are limited in types and we still rely much on human experience and random control and the work using microcomputers and microprocessor based calculators is hung up at the laboratory stage.

5. Processing Materials, Auxiliary Materials and Auxiliary Equipment Are Incomplete

In processing materials, for example: heating salts, deoxidizers, various types of (shenji [3334 0495]), hardening mediums, antioxidants and anti(shenji), cleaners; auxiliary materials such as: catalysts, molecular sieves, heating elements, heat-resistant members, heat-shield and insulating materials; auxiliary equipment such as: hardening machine tools, cleaners, ac/dc motors, pumps, valves, and conveyors. These materials and equipment,

similarly are guarantees of correct implementation of processing but for a long time have not been seriously regarded and standardization, serialization, and commercialization of production and supply should be carried out as rapidly as possible.

6. Level of Specialization Is Low

During the Sixth 5-Year Plan the heat treatment industry went through specialization readjustment and reorganization and achieved some results in energy saving, environmental protection and stabilization of quality and 23 specialized plants (including branch plants) were constructed throughout the country. However, the main body of the heat treatment industry is still large comprehensive and small comprehensive enterprises, equipment use rate and start-up rate are both low (both approximately 25 percent), energy consumption is high (averaging 1200 kwh/t), costs are high, there is pollution, and quality is poor, and these are still common problems in the industry.

7. Management Is Backward, Quality of Personnel Is Low

Technological workers as well as engineering technology personnel (including managers) lack organized and planned training and strict assessment, and lack effective scientific management systems.

If the above primary problems can be systematically resolved, there will definitely be a change in the appearance of China's heat-treatment industry.

B. Heat-Treatment Technology Development Policy

Take guarantees and improvements in the quality of machine products as the fundamental goal constantly save energy, save materials, lower costs and implement safe production. Overall development of such heat-treatment technology as processing, equipment, monitoring and control, processing materials and auxiliary materials and auxiliary devices. Some technology policy problems should also be given full consideration. For example:

1. The energy source for heat treatment is currently primarily electricity but we should suit measures to local conditions and adopt oil and gas fuels.

2. General international technical standards should be directly and equivalently adopted in processing, equipment and monitoring methods. The standards of industrially advanced countries should be used as reference points for heat treatment standards for machinery and spare parts and in this way bring along scientific research, promotion, importing, technical reform, new product development and upgrading and export work.

3. Give serious consideration to improving and perfecting conventional processing, fully exploit the potential of such conventional and traditional processes as hardening, tempering, normalizing, annealing, carburization, and nitridation, and on the basis of scientific testing, determine optimum processing standards and strictly control processing systems and parameters.

4. Vigorously develop nonoxidized and denitrified heat-treatment technology, automobile and tractor gears, bearings, fasteners, springs, and chains, develop controlled atmosphere heat treatment using propane as the raw material, and at the same time develop nitrogen base atmospheric heat treatment. Improve the level of drop injection-type controlled heat treatment, emphasizing single item and small batch spare part coating protection technology. Vacuum heat treatment should be actively used for such precision parts as industrial dies.

5. Depending on the specific service conditions of spare parts, more selectively use various types of new chemical heat-treatment processing which is highly effective, superior in quality, low in temperature and nonpolluting. Promotion must go through testing and comprehensive analysis of technological economy to guard against recklessness.

6. Promote in a key way such processes as controlled atmosphere and vacuum hardening, induction heat treatment, single element and multielement (gongshen [0364 3334]) and compound (shen [3334]), generally improve the application level of ion nitridation actively develop such new technologies as ion carburization, sulfurization, boronization, and ion (shenjinshu [3334 6855 1466]). Promote application of and constantly improve existing oil-base hardening medium series products, actively research water soluble hardening mediums and gradually develop a series. Digest the advanced chemical and physical gas deposit technology absorbed and broadly use it for surface processing of industrial dies.

7. Vigorously research and develop low temperature, surface, partial and implement energy-saving process merging heat treatment, emphasize application of rare metals in chemical heat treatment, research (cuishen [0275 3334]) and strengthening mechanisms. Develop compound heat treatment which can carry out multiple functions (such as: antifriction, corrosion resistance, durability, decorative) and strengthen malleability, start research and application as appropriate on high energy density laser and electron beam heat treatment and ion injection.

8. Gradually eliminate the four major categories of old equipment, reforming old equipment should adopt high quality ceramic fibers and superlight adiabatic materials, improve airtightness and evenness of furnace temperatures, gradually implement shielding gas operations and equipment which has no renovation value should be immediately eliminated.

9. On the foundation of improving processing parameters and processing systems, broadly adopt single-board computer and microprocessor controlled industrial processes and parameters.

10. Fixed point production of the instruments and gauges, processing materials, auxiliary materials, and auxiliary equipment needed for heat treatment should be implemented and serialization and standardization gradually be carried out.

11. Eliminate lead bath and cyanide salt operations, at fixed intervals monitor the harmful substance content of waste water, waste gas, and waste sediments, strictly control the three wastes and achieve the demand of the state for standards for the elimination of the three wastes.

In summary, accompanying competition in domestic and international markets, peoples' demands for quality, useful life and reliability for electromechanical products are increasing, and the important function of heat-treatment technology must receive more attention and serious consideration. Through the dedicated struggle of the broad heat-treatment workers, under a unified plan, strengthen leadership, stress the crux of the situation, break through at key points, stress policy and adopt corresponding measure and give guarantees, China's heat-treatment technology is bound to put on an encouraging appearance of advancing by leaps and bounds.

8226/13046
CSO: 4008/2076

FRG-PRC COLLABORATION ON MPC75 AIRCRAFT

Duesseldorf VDI NACHRICHTEN in German 9 Jan 87 p 1

[Article by Barbara Odrich: "Development of a Medium-Range Commercial Airplane: European-Asian Cooperation?: Sales Potential Estimated at 1,200 Units"]

[Text] Tokyo, 9 Jan 87 (VDI-N)--Far-reaching cooperative agreements on commercial aircraft construction between European and Asian companies can be expected in the current year. The initiator of the program currently known as MPC75 is the German aircraft manufacturer MBB, in Munich. This West German company has been negotiating for some time with partners in the Far East and in Europe.

The Chinese CATEC (China National Aero-Technology Import and Export Corporation) is also involved in preliminary studies. The goal of both MBB and the state-owned Chinese airplane industry is to win over the Japanese aircraft manufacturers--in concrete terms Mitsubishi Heavy Industries, Kawasaki Heavy Industries and Fuji Heavy Industries--as partners. In Europe, MBB is negotiating with the Dutch aircraft producer Fokker, for whom the MPC75 would provide a significant complement to its other offerings in commercial aircraft.

From the West German (MBB) point of view, the involvement of other partners is an obvious advantage. This is in order to distribute the burden of financing--at least $2 million in developmental costs plus the later investments in serial production--as well as to expand the potential market for the new airplane.

Preliminary decisions on the joint project are expected in 1987. The decision on manufacture will probably not be reached until 1992. The licensing of the new aircraft could then be expected around 1995-96. Sales potential for the airplane is estimated at up to 1,200 units, of which only up to 200 could be taken by Chinese civil aviation.

12271
CSO: 3698/297

PRC IN COMPETITION FOR CUSTOMERS TO LAUNCH SATELLITES

Bern TECHNISCHE RUNDSCHAU in German No 12, 20 Mar 87 pp 96-7

[Article by Men J. Schmidt: "Intensified Chinese Space Activities"]

[Text] The attention of the West was drawn to China in October 1985 when representatives of the People's Republic signed an agreement in Sweden on a launch of the Swedish "Mail Star" satellite with the Chinese "Long March-3" rocket. This signified the first West European customer for China, the newcomer in commercial space travel.

Just 6 months earlier, the Chinese had offered to put Western satellites into the earth's orbit using CZ-3 ("Long March-3") rockets. This was to be done at around a 15 percent savings over launches with the European Ariane rocket. At that point, the Chinese indicated that they already had eight reservations for satellite transports. This statement astonished experts all the more so since up to that point China had conducted only one successful launch with the CZ-3 rocket (on 8 April 1984).

More Highly Developed Intercontinental Missile

The path to China's highly modern and powerful carrier rocket came by way of the CSS-X-4 intercontinental missile. This is a two-stage rocket measuring 32.57 m in height, with a launch weight of 191 t. The first stage is 20.80 m high and is equipped with four power units that generate a total thrust of 280 t (2,744 kN). In the meantime, this rocket has being offered as the CZ-2 ("Long March-2") for satellite transports into lower orbit. In these orbits (approximately 300 km), it is capable of carrying around 1,300 kg. The CZ-2 has been in use since 1974, and has put, among other things, the China 3 satellite, with a mass of 3,500 kg, into an orbit 186 x 464 km above the earth. The last payload carried by this type of rocket was the "China 19" payload, which was put into a 172 x 388 km orbit on 6 October 1986. This was an earth reconnaissance satellite that returns the photographs taken to earth in special containers. Thus, the CZ-2 launched all the satellites beginning with CZ-2, with the exception of China-14, -15 and -16. The Chinese are currently studying a refitting of the CZ-2. Among other things, the carrier rocket is to be equipped with additional solid-fuel booster stages--between four and eight of them--in order to put payloads into geostationary orbit. The Chinese plans were presented at the IAF congress in Innsbruck.

"Long March-3"--Preparations for Launch

At the moment, however, the CZ-3 is China's strongest carrier rocket. It was put into service in 1984 and is designed to put payloads into geostationary orbit. The "Long March-3" carrier rocket is a three-stage transport rocket with a launch mass of 202 t and a height of 43.25 m. In comparison, the European Ariane 1 rocket is 47 m high and has a launch mass of 210 t. The diameter of the CZ-3 first stage is just short of 3.35 m. This rocket model is essentially derived from the CZ-2, but it is also equipped with a cryogenic third stage, which means that the transport capacity can be increased considerably. With an orbit inclination of 31.1 degrees, the CZ-3 is capable of putting a satellite weighing 1,400 kg into geostationary transfer orbit. The first launch of this model of rocket took place on 29 January. The launch was only partially successful, since the third stage failed. In two later launches, payloads were put into geostationary orbit.

At present, the Chinese are preparing another launch of a CZ-3. As announced by the "Great Wall" industrial combine, the Chinese plan to carry out up to 12 launches of this commercial rocket. To this end, a new launch facility was set up near Chengdu, which is at a latitude of 28 degrees north. The new launch facility is called Xichang and was set up in 1984 for the "Long March-3" rocket. Recently, the Chinese have begun to build a second launch platform so that launching capacity can be doubled.

In contrast, the CZ-2 model rockets were launched from the Jiayuguan facility in the northwestern part of the country in the Gobi Desert (40.25 degrees north and 99.5 degrees east). This space center, the name of which means "east wind" and which was the most important center until 1984, has been in use since 1960. At that time, the Chinese were able to enter into space travel with Soviet assistance. For the most part, China initially used the Russian "Sandal" SS-2 intermediate-range rockets, which were built under license. The two-stage SS-2 was developed further and given a third stage. As a Chinese intermediate-range rocket, it was called the CSS-X-2. The first two satellites were launched with this rocket, which was renamed CZ-1, or "Long March-1." The rocket, 30.75 m in height, is no longer in use.

Massive Solicitation of Customers

The desire of the Chinese to have a say in future commercial satellite transports is evidenced by their presence at a variety of international space congresses and exhibitions. In addition, intensive negotiations with various countries concerning satellite transports are underway. Besides Sweden, agreements on satellite launches have been reached with other countries as well.

Teresat (Houston, Texas) plans to put the two defective satellites brought back by the Shuttle in 1984 ("Palapa" and "Westar," which have since been repaired) back into their original destination orbits with the help of the Chinese carrier rocket. It has signed an agreement of intent to this effect with the Chinese "Great Wall Industry Corporation." According to this agreement, the satellites will be put into orbit between October and December

1987, and the Chinese company promises to make use of its "best possible services" to obtain the necessary loss liability guarantees from the Chinese state "national insurance company." The original plans for the reuse of these satellites involved insuring them through the English insurance company Merritt Syndicates Ltd. (London) and the U.S. insurance company International Technology Underwriters (Washington, D.C.), which insured the return of the two satellites; however, these companies set the condition that the satellites be transported using the U.S. Shuttle, which NASA had accepted as a given. In legal terms, NASA must now issue special approval for the launching of the satellite by a carrier rocket other than the Shuttle. Negotiations on this point are still underway.

In May 1986, representatives of the European Space Agency (ESA) visited the People's Republic of China at the invitation of the latter in order to discuss the possibilities of launching European satellites using Chinese carrier rockets. Furthermore, the Chinese plan to keep the Europeans up-to-date on their non-military plans in space.

The U.S. Westar 6 S satellite is also to be launched in 1988 with a CZ-3 rocket; the relevant agreement has been signed. Similarly, it was announced at the end of October 1986 that a relevant agreement has been reached with Iran concerning the launch of a communication satellite. Brazil could be another potential client for the Chinese "Long March-3" rocket. A corresponding offer was made to Brazil by the "Great Wall" industrial combine, a division of the Chinese Ministry of Astronautics. If all the interested parties do launch their satellites in the coming years with the Chinese CZ-3 rocket, China could develop into a serious competitor to the United States and Europe in the satellite transport business.

12271
CSO: 3698/427

SHENYANG BROKERS HELP SET UP TECHNOLOGY MARKETS

OW121245 Beijing XINHUA in English 1116 GMT 12 Apr 87

[Text] Shenyang, 12 April (XINHUA)--Some 1,000 brokers here have played an important role in an effort to set up technology markets.

Administrative separation in the past in China tended to hinder new discoveries of research institutions from entering enterprises. In 1980 the city of Shenyang started experimenting with technology markets to solve the problem.

"These first brokers in new China have helped as mediators between research institutions and enterprises for a quicker flow of technology products," said an official from the Technology Market Study Association of this capital city of northeast China's Liaoning Province.

The association has so far trained more than 800 brokers in technology marketing, economic laws and regulations, and technology transfer contracts.

The local government recently issued "technology traders" identification cards to 300 people specialized in technology trading.

Liu Zizhuang, a broker for the Automation Research Institute of the city, signed sales contracts for technology valued at 410,000 yuan (about U.S.$11,700) in 1985, his 1st year as broker for the institute. The figure formed one-fifth of the institute's total technology transactions volume for the year.

/12232
CSO: 4010/47

ROLE OF INTERMEDIARIES IN S&T MARKETS

Tianjin JISHU SHICHANG BAO in Chinese 7 Jan 87 p 1

[Report by Liao Jiyi [1394 0679 1355]: "On the Self-Improvement of Intermediary Organizations in the Technology Markets"]

[Text] At present, there are already more than 5,000 intermediary organizations in our technology markets, which constitute a preliminary circulation network for technology commodities that has multiple channels and many levels. In these new conditions, just how these intermediary organizations are to develop and perfect themselves is a new topic. It is my belief that in scope of operations, operational techniques, and operational strategy, the intermediary organizations should restructure themselves appropriately and take as their footholds the rapid transferral of information, participation in complementary technology development, the appropriate establishment of testing bases, and sincere top-quality service.

1. They should strengthen the establishment of science and technology information data banks to transmit information for top-quality service. To be an intermediate structure in the technology markets, an organization must have its own data bank to provide both buyer and seller with information on supply and demand for guidance, and to gradually constitute a scientific and technical information transferral system with its own advantages. They should both provide invitations for bidding on difficult technical topics, and also should undertake the prompt dispersal of information on achievements in science and technology and on development; and they should both do surveys of conditions regarding supply and demand, and also should undertake systematic processing. This intermediary function between science research and production regarding the transferral of information will promote technology transactions.

2. They should participate in the development of complementary technologies to hasten the substantiation of technology commodities, to allow commodities of an intellectual state to be transformed in to production forces as quickly as possible, and to serve the improvement of the rate at which the achievements of technology are transformed, disseminated, and applied and the rate of their implementation. Various specialized organizations engaged as technical intermediaries dispersed throughout society, that is, various technology development and consulting service organizations, aside from being

good intermediaries and transmitting information, should comply with trends and actively participate in the complementary development of technologies to supplement certain weaknesses where individual technical achievements are not complementary and cannot be directly used in production. There should also be corresponding improvements in aspects such as the internal structure of technology intermediary organizations and the quality of operations personnel.

3. They should open up new paths to technical training to broadly develop technology transactions within the fields of technology training. Intermediary organizations should develop technical training undertakings in accordance with the needs of those they serve, and which should be suited to local conditions. In this way, they will have both expanded technology and also trained skilled personnel, which is a good method for achieving many things in one action.

4. They should function to promote the flow of scientific and technical intelligence. In recent years, the distribution of scientific and technical power has been uneven in some areas, some units having surpluses and some deficiencies. Faced with this kind of situation, they could organize the spare-time engagement in technical activities by scientists and technicians. In this way there is both an unearthing of scientific and technical intellectual resources and also a way to allow the achievement of technology to be used as quickly as possible by enterprises.

5. They can utilize unemployed and retired scientists and technicians to develop rising new industries for the complementary development of technologies for knowledge commodities. In recent years, unemployed and retired scientists and technicians in all areas have been organized, and have been organized into various specialized technology development structures, which is a good format.

Naturally, the self-improvement of intermediary organizations still requires the support of all aspects of society, as for example in the collection of fees, remuneration, tax revenues, and funding sources, all of which require a comfortable, relaxed environment. These things then require pertinent areas to provide support.

12586
CSO: 4008/2060

PRC TO HOLD TECHNOLOGY TRADE FAIR IN HONG KONG

HK100448 Hong Kong ZHONGGUO XINWEN SHE in Chinese 0628 GMT 8 May 87

[Excerpt] Hong Kong, 8 May (ZHONGGUO XINWEN SHE)--Ninteen well-established science and technology foreign trade companies in the hinterland will for the first time jointly hold a large-scale industrial technology trade fair in Hong Kong.

It has been decided that the trade fair will be held at the Hong Kong Exhibition Center in December this year. More than 500 new technologies, including space technology, nuclear energy, metallurgy, electronics, chemical industry, instrument-making, machinery equipment, and construction materials, will be on display. Both the scale of the fair and the number of items on display are rarely seen in Hong Kong.

The companies participating in the trade fair are: China Space industry Science and Technology Consultant Corporation, China National Aero-Technology Import and Export Corporation, China Nuclear Energy Industry Corporation, China National Metallurgical Products Import and Export Corporation, China National Chemical Construction Corporation, Beijing branch of China National Electronics Import and Export Corporation, China North Industries Corporation, China Petro-Chemical International Business Corporation, China Great Wall Industrial Corporation, China Huayang Technology Trade Corporation, China National Nonferrous Metals Import and Export Corporation. China National Machinery and Equipment Import and Export Corporation, China Engineering Industry Corporation for Foreign Economic and Technical Cooperation, China National Technical Import and Export Corporation, China Medicines Corporation for Foreign Economic and Technical Corporation, China National Science Equipment Corporation, China National New Building Materials Import and Export Corporation, Tianjin New Technology Development Corporation, Dongfang Scientific Instruments Import and Export Corporation, and Zhongyuan International Economic and Trade Corporation of Henan.

/12232
CSO: 4010/47

GEOLOGISTS FIND MINERALS WITH LATEST TECHNIQUES

OW180736 Beijing XINHUA in English 0729 GMT 18 May 87

[Text] Chengdu, 18 May (XINHUA)--Geologists have found more than 400 minerals deposits in Sichuan, Yunnan and Guizhou Provinces and the Gangxi Zhuang Autonomous Region since 1981, according to local authorities.

The deposits of iron, tin, manganese, tungsten, copper, phosphorus and gold were located using the latest theories, techniques and equipment, including plate hypothesis, multiple mineralization, sedimentology, modern stratigraphy, remote sensing, chemical spectrum analysis and computers.

Geologists used the plate hypothesis to determine that an area in Sichuan was mineral-bearing as it was located on an ancient rift valley, said Luo Yaonan, deputy chief engineer of the Sichuan Geology and Minerals Bureau.

Now they have discovered deposits of 54 minerals with industrial value in the area. The verified iron reserve amounts to nearly 10 billion tons.

In Yunnan geologists located a new tin zone, in which 20 deposits have been found, including 3 large and 6 medium-sized ones.

With new techniques and equipment, the geologists have improved their measuring, drilling and laboratory tests and raised the precision of sample analyses.

/12232
CSO: 4010/47

LEGAL MEASURES FOR PROMOTING S&T DISCUSSED

Beijing XIANDAIHUA [MODERNIZATION] in Chinese No 3, 25 Mar 87 pp 12-14

[Article by Wang Yijun [3769 0076 6511]: "Legal Countermeasures Designed to Promote S&T Advances in Enterprises"]

[Text] In today's incessant move toward bolstering and strengthening the building of a socialist legal system, law is bound to have a profound impact on the advancement of S&T in enterprises. Law is going to play an ever more important role in ensuring S&T advancement in enterprises, spurring S&T activities, orchestrating the various community relationships S&T gives rise to, and determining the path of future S&T development. For this reason, channelling S&T advancement in enterprises into the socialist legal system has become something both urgent and necessary.

A Powerful Tool for Spurring S&T Restructuring

Even though the technological base of China's national economy has shown a marked improvement over the past, it is still quite backward. The net worth of fixed assets in many large and medium sized key enterprises are up only 40 to 50 percent from early figures. In Shanghai, for instance, technological performance and equipment across the board in industrial enterprises was only up to the international standards of the fifties and sixties in around 70 percent at the end of 1985. Twenty percent were up to the level of the seventies and those up to the levels of the early eighties amounted to only 7 percent. It is in the large and middle sized enterprises that the phenomenon of obsolescent facilities is most severe. This inevitably leads to such numerous problems as high levels of wasted materiel, lowered potential for improvement replacement of products, and lack of competitive edge in the market, even to the point of being regressive in some sectors. This not only affects state revenues, but also increases the gap between China and the developed industrial nations.

Analysis reveals that the following major factors have helped bring this situation about:

Lack of Capital. When the second phase of changing from turning over profits to paying taxes was implemented, the tax burden on some large and mid-sized enterprises was too great. Adjustments in tax collections in particular led

to a situation where "the ox was whipped to speed it up." As a result, the after tax profit levels of enterprises which had originally been well run and profitable was lowered. In some heavy industries the per capita after tax profit was just over 100 yuan. Consequently, these enterprises lost their capacity to bring about their own reorganization.

Imbalanced Quest for Output Value. The one-sidedness of certain policies led enterprises to using demonstrations and special proposals as shortcuts to increased output value. In recent years, enterprises have shown much less enthusiasm for reorganizing their S&T than for proposing special projects. Likewise, with demands on some enterprises high, they continue to make considerable earnings without any need to innovate their technology, so there is little impetus for technological reorganization.

Inadequate Concern for the Long-term

When the cadre appointment period system was implemented, the prevalent concern of enterprise leaders was always how to increase output value during one's own term, while consideration for such long-term interests as technological restructuring and innovation and newer product replacement faltered.

Over and above these factors, the lack of the requisite legal underpinnings for restructuring an industry's technology was a major factor holding innovation back. At the present time, China still has no full-blown collection of laws and regulations to guide technological innovation for industry as a whole. Furthermore, the existing relevant laws and regulations lack sections guarding technological advancements or offering incentives or sanctions regarding the work of restructuring an enterprise's technology. From the standpoint of enforcement, laws on the books which are not enforced or only sporadically enforced have become downright widespread. The administrative laws and regulations China already has promulgated are still not being conscientiously implemented.

There is now a practical pertinence in using legal methods to spur technological advances in enterprises and improving measures for managing those advances. Legislative adjustment of social relationships can create a favorable social climate for advancement of enterprise technology. Fine-tuning S&T with the emergent social economy and relationships with material production may be sufficient to upgrade the receptivity of the enterprise toward technological restructuring, ensure that these efforts will go smoothly and effectively, and at the same time relieve or eliminate the negative impact of the unfavorable elements mentioned above.

In this regard, the experience abroad provides a wealth of lessons to us. The Japanese government, faced with a weakening technologuical base in its small and mid-sized enterprises, drafted a series of pertinent laws and regulations such as their "Basic Law on Small and Mid-sized Enterprises" and "Law Promoting Modernization of Small and Mid-sized Enterprises." Both these laws contain concrete rules on modernizing their facilities, upgrading their technology, and improving operational management. The law both protects and promotes development of these enterprises.

Based upon reports, China's new enterprise law is now being drafted. This enterprise law should set forth clear rules with widespread enforceability on the formulation of longterm planning for technological restructuring of enterprises, how that restructuring is to be organized, what rights and responsibilities the enterprises themselves hold in these areas, the source of operating expenses, and economic liabilities.

There should be legal countermeasures for the problem of lack of funds for reorganizing the enterprise as well. Tax laws now in effect should add provisions which favor technological advancement for enterprises and technological reorganization. Such would improve the enterprises receptivity toward undergoing technological reorganization. There should also be clear-cut rules with real safeguards on loan preferences for technological reorganization of enterprises-- especially key large and mid-sized ones. There should be administrative or legal sanctions against diversion of those funds to other uses.

In order that the leading individuals in enterprises can take technological reorganization of their plants into account in a timely fashion, upholding of enterprise quotas for reorganizing technology and promotion of technological advances within the enterprise should be made a task of plant managers and a major benchmark in examining and supervising them and determining whether they can serve another term. In this way, the concern and sense of responsibility among leading individuals in an industry toward adopting S&T results and advanced expertise will be enhanced. It will channel their attention toward a search for technological improvements and upgraded economic returns.

The Role of Law in Quality Control and Technical Development

Product quality is the most objective and comprehensive indicator for measuring an enterprise's technical advancement, how well its production is organized, and the attainments and discipline of its workers. It reflects overall the technological level of the national economy and is, moreover, a benchmark for an enterprise's real technical capabilities. In today's world, whatever products meet the needs of society for high quality and reasonable price and which have the ability to compete in the international marketplace must all have some degree of technical content.

In China's current situation, this link is particularly weak. Preliminary studies of state and ministry standards currently in force reveal that only around 20 percent are equivalent to generally accepted international standards. Even if those products manufactured in accordance with currently held standards meet them 100 percent, this is still a very low level of quality. What is worse is that the products of many companies do not even meet these standards. These problems have never been fundamentally resolved, owing to lack of constraints and sanctions imposed by a system of narrowly drawn laws.

Many nations around the world today have drafted laws to systematize management of and give legal effect to such links as manufacturing, testing, delivery preparation, sales, storage and transport, and utilization. Many

continue to draft and promulgate what primarily amounts to product responsibility laws and regulations. One of the primary roles of these laws and regulations once they go into effect is to make producers pay greater attention to their responsibility for production technology.

In a move to make its enterprises upgrade product quality to increase returns and spur technological advancement, China has drafted certain laws and regulations to promote and preserve this endeavor. In April 1984, the State Council issued and implemented the "Provisional Rules on Industrial Product Licenses." Further, in May 1985, it released the "Rules on Responsibility for the Quality of Industrial Products." This was an auspicious beginning to China's utilization of legal means to manage industry, and in particular, to oversee the quality of industrial products.

But as far as legal means go, inadequacies still exist. The authority of Law still needs improving and strengthening. The disparity between product quality standards in China and those generally held internationally is not favorable to entry of China's goods onto the international market. Thus, when measuring product quality, we must adopt international standards and eliminate shoddy goods. In order to reach this goal, concrete and feasible regulations in the form of laws must be used to deal with problems with product quality standards in order to hold them more strictly accountable. With the endless improvement of product quality standards among the industries of all the nations in the world in mind, China must set annual deadlines for implementing standards in the codes and implementing regulations on licenses for various products if the role of such standards in ensuring economic development and promoting technological advancement is to be attained.

In recent years, there has been a trend toward strengthened lateral relationships between enterprises, S&T units, and academic institutions abroad, and joint entities of all sorts between production and S&T have proliferated. These link-ups have brought about a significant breakthrough in the S&T capabilities of enterprises. Japan has established and strengthened its system for S&T research and development, and has been pushing forward on cooperation between businesses, universities, and official research agencies. The British government is encouraging universities and scientific research agencies to license their research results to enterprises. France and West Germany encourage exchanges of personnel between businesses, institutions of higher education, and research agencies; furthermore, these governments have promulgated specialized laws to protect and promote such exchanges.

In China, in line with requirements for S&T development and advances in S&T in enterprises, a large number of research and production joint entities between large and mid-sized enterprises, scientific research units, and universities have sprung up. A considerable segment of these joint entities already have a degree of depth and breadth. The establishment of such entities is a realization of the integration of scientific research, design, intermediate trials, and production which brings about a coordination of all S&T strengths to form a comprehensive capability to tackle S&T. Speaking for enterprises, link-ups strengthen their own capability to absorb and exploit technology.

Given the fact that these joint entities are composed of a number of different units, such issues as the rights and responsibilities of the participating units, relationships between such various links between research and production, sources for operating expenses and economic liabilities become part of the agenda for discussion as these joint entities continue their incessant growth. For this reason, formulation of a specialized law to tune relationships between the various aspects and links of the joint entity has become an urgent matter. In this regard, we can avail ourselves of experience abroad in the use of legal methods to promote close cooperation between business, scientific research, and the universities and to encourage exchanges between scientists, professors, and engineering technicians which can strengthen an enterprise's capacity to exploit technology and bring the relationships between various joint entities into line, so that this enhanced capability of businesses to exploit technology can become effectively more legal and systematic.

Strengthening Effective Measures for Managing Technology Indroduction

In the course of recent history of the development of the world economy, some countries with rather sluggish economic development have been able to accelerate it by introducing advanced technology from abroad, a major route for those countries toward economic take-off. West Germany was successful in surpassing England in industrial technology by importing the technological fruits of the English industrial revolution. Part of the reason the United States was able to overshadow Europe in the middle of this century in a rather short time was by importing the results of advanced European technology. Japan is an even better example of a country which moved its economy in one short leap to be the second "economic power" by vigorous importation of advanced European and American technology. India was a poor backward nation at independence, but has greatly developed its industry by using foreign capital and importing facilities. One common experience in the successes achieved by these countries is this: the use of legislation to protect and promote the importation of advanced technology by enterprises.

Technology, equipment, and technical levels in the vast majority of China's businesses are currently far below those of advanced nations. The labor production rate in some of the major industries and sectors is 20 or 30 years behind that in the technologically advanced nations. Now, in the face of the challenge of the worldwide revolution in new technology, advanced S&T results crop up continuously. If we can make the best of this opportunity to introduce advanced technology from abroad, we may be able to skip over some of the traditional stages of industrial development, lessen the disparity between China and the technologically advanced nations, and fundamentally change the current condition of our industries.

Ever since China has put into effect its policy of opening up to the outside, a number of enterprises have imported quantities of advanced equipment and technology from abroad, which hasd played a role in pushing forward the speed of their technological advance.

But it cannot be denied that many problems exist in technology importation. Orders have come from different sources, resulting in serious reduplications in technology importation. Dislocations between importation, assimilation, and popularization have been widespread. More equipment has been imported than technology, and some of it is just ordinary assembly lines with short-lived technology or low quality which can only be used to meet the short-term demands of the domestic market, while the amount of advanced technology being imported which China must have for its long-term economic development is very low. Import contracts have not been rigidly enforced. These have led to losses for the state and for enterprises to varying degrees.

A key factor in the existence of the problems mentioned above, over and above defects in management systems and the lack of funds, is the fact that there is a lack of requisite legal steps in many areas of technology importation work.

In most of technology importation abroad, management is strengthened through legislation. This is especially true in the developed nations, where an understanding of the importance of strong laws concerning technology importation has been gleaned from practice in that particular country. Some countries not only draft particular laws, but also gradually draft whole systems of specialized ones. Moreover, it is through the exercise of these laws that the scope of commodity imports is controlled, the fact that the imported technology is state-of-the-art and suitable is assured, duplicate importation is avoided, and systems of inspection and approval are made strict.

Ever since China started implementing the policy of opening up to the outside, it has drafted and promulgated several tens of such laws, of which the major ones are the Implementing Regulations of the Enterprise Law for Chinese-Foreign Joint Ventures, the Foreign Economic Contract Law, and the Patent Law, all of which have extremely important significance for guiding the work of technology importation. Nevertheless, the gap between law-making and the demands of the real world is wide and some areas are total blanks. These are the areas for which formulation of laws must be considered quickly.

First, there should be overall national control of technology importation, and the establishment of a central management agency for technology importation. Laws should be drafted which set forth the legal status of such an agency, its tasks and goals, and the purview of its authority. This agency should oversee technology importation nationwide and coordinate all the various relationships. At the same time, taking into account the continuity and connectedness of S&T development, state policies on opening up to the outside and importation of foreign capital should be fixed in the form of laws. This will ensure their stability and long-term effectiveness.

Priorities and fields of technology importation should be fixed by law. Inspection and approval procedures for technology importation should be simplified and made scientific and reasonable. Moreover, the rights, duties, and responsibilities of enterprises importing technology should be clearly delineated. Only thus can illegal activity in the area of technology importation be squelched and economic returns be improved. Dealings with foreigners are particularly serious and complex. There are vast differences

between balancing the relationships between the parties and overhauling relationships between the nation's interests. This must be fully considered when the laws are being drafted.

At the same time, relevant laws which give incentives to enterprises to digest and absorb innovations should be formulated, and incentive systems should be set up for those enterprises which excel in this regard. In the reverse situation, there should be sanctions and a determination of liabilities. Laws covering financial matters should be written which earmark special funds for enterprises to absorb technology. This will mobilize enthusiasm for such activity among enterprises.

From the standpoint of China's current situation, the time has definitely come for the use of law-making to promote technology importation by enterprises. Conditions for it are ripe as well. Thus, the drafting of a quite comprehensive law covering technology importation be enterprises is an important task facing China.

The issues involved in technology importation by enterprises are unique. In response, laws in this area must have their own special features. As be strengthen law-making, we must also strengthen theoretical research and exploration, under the present conditions, into how we might further activate the role of law in promoting economic construction. Moreover, we should draft legal measures in a timely fashion, based upon the national situation and the incessant emergence of new problems, to gradually perfect technological management systems.

12303

CSO:4008/2105

1986 HIGH-GRADE ELECTRONICS PRODUCTS LIST

Beijing DIANZI SHICHANG in Chinese No 51, 18 Dec 86 pp 1, 8

[Text] Table of Ministry of the Electronics Industry 1986 High-Grade Products

Tradename, Model, Name	Producing Unit
Beijing (25 items)	
6N16B-Q subminiature electronic tube	State-run Beijing Electronic Tube Plant
(G)CC4066 four bi-directional switches (IC)	Beijing Semiconductor Parts Plant No 3
(G)CA solid-state electrolytic sintered tantalum capacitor	State-run Beijing Radio Equipment Plant No 3
"Mudan"-brand MB-214 dual-cartridge stereo AM-FM receiver-recorder	Beijing Radio Plant
"Beiguang"-brand GS2-3 TV transposer	Beijing Broadcast Equipment Plant
"Duoyuan"-brand 2J8007-1 power source transformer	Beijing Broadcast Parts Plant No 2
"Qixing"-brand R4061 two-channel record/playback head	Beijing Broadcast Television Parts Plant No 7
"Beichun"-brand JS-3 antenna input for television use	Beijing Broadcast Parts Plant No 5
"Mingxing"-brand HA-10 pulse push-button telephone	Beijing Radio Plant No 3
FU-101F high-power metal ceramic transmitting tube	Beijing Electronic Tube Plant
3DK101NPN silicon low-power switching tube	Beijing Semiconductor Parts Plant No 9
3CK121PNP silicon low-power switching tube	Beijing Semiconductor Parts Plant No 5
"Beijing"-brand Great Wall 0520A microcomputer system	Beijing Wire Communications Equipment Plant

"Beiyan"-brand CZ-1206 function microcomputer	Beijing Computer Plant No 2
"Hailang"-brand CC1 wafer ceramic dielectric condensor	Beijing Radio Parts Plant No 6
"Youyi"-brand CA42 resin wrapped solid-state electrolytic tantalum capacitor	Beijing 2d Radio Equipment and Materials Plant
"Feixiang"-brand CL232 metallic polyester-membrane capacitor	Beijing Radio Parts Plant No 2
"Feixiang"-brand CL21A metallic polyester-membrane capacitor	Beijing Radio Parts Plant No 2
"Heli"-brand CBM-443BF thin-film dielectric four-bar variable condensor	Beijing Broadcast Television Parts Plant No 6
"Feixing"-brand HXC-14A 75 cm low-power waveguide circulator	Beijing 3d Radio Equipment Plant
"Youyi"-brand RJ14 metallic-membrane resistor	Beijing 2d Radio Equipment and Materials Plant
"Sanjian"-brand RJ14 metallic-membrane resistor	Beijing Municipal Radio Parts Plant No 1
"Zhinan"-brand organic active flux	Beijing Municipal Chaoyang District Flux Plant
YD58-1N electrodynamic paper-cone loudspeaker	Beijing Municipal Electroacoustic Equipment Plant
CJ-1B clean worktable	Beijing Semiconductor Equipment Plant No 1

Tianjin (14 items)

"Youyi"-brand 351-2 monochrome TV set	Tianjin Radio Plant No 4
"Beijing"-brand 864 monochrome TV set	State-run Tianjin Radio Plant
"Xing"-brand 559 dual-cartridge stereo separates portable receiver-recorder	Tianjin Broadcast Equipment Plant
"Tianjin"-brand ZT-6B hearing aid	Tianjin Municipal Hearing-Aid Plant
"Yuansan"-brand 076 14" monochrome TV set power source transformer	Tianjin Radio Parts Plant No 3
"Sanfeng"-brand LX-401 recording chip	Tianjin Jinhua Radio Plant
"Huanqin"-brand TL7-240 rotary telescopic antenna	Tianjin Radio Parts Plant No 7
"Sanhuan"-brand PC boards for use in monochrome TV sets	Tianjin Printed Circuit Board Plant
3CL24-29 glass packaging high voltage silicon rectifier stack	Tianjin 3d Semiconductor Plant
"Tianci"-brand MS 4 X 0.7 X 8 R40 threaded magnetic core	Tianjin Magnetic Materials Main Plant

"Zhenmei"-brand YDG50-series electrodynamic high-frequency loudspeaker	Tianjin Electroacoustic Equipment Plant
"Hongyan"-brand SYV-series solid polyvinyl insulated RF electrical cable	State-run Tianjin Electric Cable Plant
"Hongyan"-brand AF-1, AFP-1 series small diameter installation wire	State-run Tianjin Electric Cable Plant
"Huanjiao"-brand YCB luminance delay line	Tianjin Municipal Radio Parts Plant No 6

Shanghai (24 items)

"Meiduo"-brand CP6962 portable AM-FM stereo receiver-recorder	Shanghai Radio Plant No 3
"Shanghai"-brand L890 separates stereo dual-cartridge receiver-recorder	Shanghai Recording Equipment Plant
"Hongdeng"-brand 2L1410 4-speaker, 4-band portable stereo receiver-recorder	Shanghai Radio Plant No 2
"Chunlei"-brand TF7050 FM transmitter	Shanghai Radio Plant No 3
"Kaige"-brand 4B19 automobile receiver	Shanghai Radio Plant No 4
"Lengguang"-brand TJT-2A UHF mechanical tuner	Shanghai Jinling Radio Plant
"Shuangdeng"-brand BSH13-N13 retrace transformer	Shanghai Radio Plant No 27
"T"-brand TL9-220-I telescopic antenna	Shanhai Radio Plant No 36
"Shangji"-brand TQHV-I Chinese character decoder	Shanghai Computer Plant
"DH"-brand Donghai 0520C micro-computer system	Shanghai Computer Plant
"Hongxun"-brand 3DD205A NPN silicon low-frequency high-power tube	Shanghai Radio Plant No 29
"Shuangling"-brand CC4518EP 2-decimal synchronized counter	Shanghai Radio Plant No 14
"Shangsi"-brand 3DG201 plastic encased low-power triode	Shanghai Radio Plant No 10
"Shuangling"-brand CS1C(3DJ6) FET transistor	Shanghai Radio Plant No 14
"Sanyuan"-brand CC1 wafer ceramic dielectric condensor	Shanghai Radio Plant No 1
"Tianhe"-brand CD11 aluminum electrolytic capacitor	Shanghai Tianhe Condensor Plant
"Sanye"-brand CL11 polyester thin-film condensor	Shanghai Radio Plant No 6
"Yuzhou"-brand WH124 composite membrane potentiometer	Shanghai Yuzhou Potentiometer Plant

"Sanyuan"-based RJ14 metallic membrane resistor	Shanghai Radio Plant No 1
"Weixing"-brand 8-position push-button switch	Shanghai Radio Plant No 9
"Haiyan"-brand 7512 shipboard navigation radar	Shanghai Plant No 101
"Xinjian"-brand XJ4810 semiconductor characteristics diagrammer	Shanghai Radio Plant No 21
"Feiyue"-brand YD103-1B, YD106-3AB electrodynamic loudspeakers	Shanghai Feiyue Electroacoustic Main Plant
"Baihehua"-brand D44-1U monochrome television set	Shanghai Television Plant No 11

Jiangsu Province (51 items)

3DD5CT NPN silicon low-frequency high-power triode	Nanjing Semiconductor Equipment Main Plant
623A ground interrogator	Yangzhou Municipal Baocheng Radio Plant
923-1 radar	State-run Xinlian Machinery Plant
TB2-354(SC801C) digital telegraphic terminal	Changzhou Computer Plant
JDT-1 short-wave single-side band transceiver	State-run Nanjing Radio Plant
(G)2CZ52A-F silicon rectifier diode	Wuxi Radio Parts Plant No 4
"Ximei"-brand TJT-2 VHF mechanical tuner	Wuxi Radio Parts Plant No 6
"Jinta"-brand BSH14-N302L integrated retrace transformer	Suzhou TV Receiver Parts Plant
"Baihua"-brand DBC-1410 power transformer	Wuxi Radio Transformer Plant
"Meihua"-brand M-301H recording chip	Wuxi Radio Plant
"69"-brand DLX-33FB recording chip	Nanjing Dongfang Electronic Instruments Plant
"Suci"-brand J24B2/X12b2D record/playback/erase head	Suzhou Magnetic Head Plant
"Xique"-brand LTS-1 piezoelectric ceramic stereo pick-up head	Changshu Radio Plant
"Hengda"-brand recording chip spring	Shazhou Spring Plant
"Yongsheng"-brand SG-FC air-cooled dust-free industrial television	Changzhou Television Plant
"Diangong"-brand 15SJ110 oscilloscope tube	State-run Donghua Electron Tube Plant
"Diangong"-brand GD-24 photocell	State-run Donghua Electron Tube Plant
"Yuhua"-brand 360 ion laser	State-run Nanjing Electron Tube Plant
"Huajing"-brand CD7611CP, CD7193CP TV set circuits	State-run Jiangnan Radio Equipment and Materials Plant

"Huajing"-brand 3DG142 NPN silicon epitaxial plane low-noise triode	State-run Jiangnan Radio Equipment and Materials Plant
"Ruiguang"-brand FG114003(BT205-2) gallium-phosphorus red LED	Suzhou Semiconductor Main Plant
3CG21 PNP silicon high-frequency low-power tube	Changzhou Radio Parts Plant No 7
"Zijin"-brand Zijin II micro-computer system	State-run Nanjing Wire Communications Equipment Plant
"Tonglin"-brand XK80A micro-processor line cutting console	Jiangnan Nantong Computer Plant
"Dujuan"-brand X8007A low-cost computer	Wuxi Computer Plant
"Xixi"-brand model CBB25 metallic polypropylene condensor	Wuxi Municipal Condensor Plant No 4
"Feiyue"-brand CC1 wafer ceramic dielectric condensor	Nanjing Radio Parts Plant No 4
"Nanrong"-brand CLII Dacron condensor	Nanjing Radio Parts Plant
"Jinning"-brand $U_{YF}14$ magnetic core	State-run Jinning Radio Equipment and Materials Plant
"Ningzu"-brand RT14 carbon-film resistor	Nanjing Radio Parts Plant No 11
"Sugao"-brand RT14 resistor using carbonized ceramic base	Suzhou Municipal High Frequency Porcelain Elements Plant
"Sanjiao"-brand RT14 carbon-film resistor	Suzhou Electric Resistor Plant
"Kuaile"-brand YDG50-1 electro-dynamic high frequency loudspeaker	Suzhou Electroacoustics Plant
"Nanjing"-brand YD58-8N electro-dynamic loudspeaker	Nanjing Electroacoustics Plant
"Lianhuan"-brand QA poly amino ester varnished round copper wire	Changzhou Radio Materials Plant
"Yuanwu"-brand KAN-J keypress push-button switch	Zhenjiang Radio Parts Plant
"Jiangnan"-brand DL-2D power source filter	Changzhou Radio Parts Plant No 2
"Shuangda"-brand SHK-20/21dB precision balance variable attenuator	Nanjing Radio Instruments Plant
"Luyang"-brand SR-071B dual-trace oscilloscope	Jiangsu Yangzhong Electronic Instruments Plant
"3A"-brand DK7725-MC2 micro-controlled line cutter	State-run Taizhou Instrument and Meter Machine Tool Plant
WGD3-85 satellite broadcast receiver	State-run Nanjing Radio Plant
"Hongmei"-brand WJD-27 monochrome TV set	Wuxi Television Receiver Plant
"Hongmei"-brand WJD-31 monochrome TV set	Wuxi Television Receiver Plant

"Meihua"-brand 912 receiver-recorder	Wuxi Radio Plant
"Sihua"-brand SX1 receiver-recorder chip	Changzhou Electrical Relay Plant
2DD-5J power carrier set	Qingjiang Radio Plant
"Longjing"-brand ϕ 30~75mm niobium acid lithium monocrystal	Xuzhou Semiconductor Materials Plant
DT-20L scheduled telephone exchange	Suzhou Dongfeng Communications Apparatus Plant
40-DDH-4A scheduled telephone exchange	Zhenjiang Municipal Wire Communications Equipment Plant
plastic thin-film phonograph record	Nantong Zhonghua Phonograph Records Plant
"Yuanleng"-brand model WS20 direct-slip composite carbon-film potentiometers	Changzhou Radio Parts Plant No 1

Hebei Province (2 items)

3CK10 PNP silicon low-power switching tube	Renqiu Semiconductor Parts Plant
"Huaning"-brand 35H-1U monochrome TV set	Shijiazhuang Television Receiver Plant

Liaoning Province (10 items)

ZQM1-100/10 deuterium thyratron	Shenyang Lightbulb Plant
WH601K2 control box	Shenyang Computer Plant
"Shenyang"-brand SD44-2M monochrome TV set	Shenyang Television Receiver Main Plant
"Dandong"-brand TJT-5 VHF mechanical tuner	Dandong Tuner Plant
"Jinhuan"-brand LX-79F8 recorder chip	Dalian Recording Equipment and Materials Plant
"Liaorong"-brand PC boards for use in monochrome TV set	Dalian Radio Plant No 14
"Shanghua"-brand WZ 1.5-0.015 miniature indicator lamp	Shenyang Semiconductor Parts Plant
"Dongguang"-brand ZKT-300/114 vacuum switching tube	State-run Plant No 8230
"3A"-brand CC1 wafer ceramic dielectric condensor	Anshan Municipal Electronic Ceramics
"Huoju"-brand Fu-501 mid-frequency glass bulb emitting triode	State-run Huaguang Electron Tube Plant
"Fuzi"-brand DL8306 receiver-recorder	Dalian Recorder Plant

Jilin Province (6 items)

"Canhua"-brand 828 F-N stereo vehicle receiver-recorder	Jilin Municipal Electronic Instrument Plant

"Canhua"-brand HDG.500.Q anti-static moving floor	State-run Plant 8201
2EF601.2EF0561.2EF641 gallium phosphide red LED	Changchun Semiconductor Plant
"Dongguang"-brand CD293 aluminum electrolytic capacitor (160V220 microfarads)	State-run Dongguang Radio Equipment and Materials Plant
"Dongguang"-brand CD30 aluminum electrolytic capacitor (160V100 microfarads)	State-run Dongguang Radio Equipment and Materials Plant
IEC30 gallium arsenide varactor diode for parametric amplifier	Changchun Semiconductor Plant

Heilongjiang (3 items)

XLG-1 training device	Mudanjiang Electronic Instrument Plant
(G)2CK28 silicon large current switching diode	Harbin Transistor Plant
"Shuangshan"-brand dual layer impurity absorbing N/N+ silicon epitaxial wafer	State-run Plant No 8233

Zhejiang Province (6 items)

"Yingchun"-brand YDG50-61 electrodynamic high-frequency loudspeaker	Hangzhou Electroacoustics Plant
"Xihu"-brand 35HJD2-1 monochrome TV set	Hangzhou Television Receiver Plant
"Hangzhou"-brand R-70KA metallic ceramic discharge tube	Hangzhou Electronic Tube Plant
"Ningrong"-brand CBB61 metallic polypropylene thin-film condensor	Ningbo Condensor Plant
"Ningrong"-brand CBB60 metallic polypropylene thin-film condensor	Ningbo Condensor Plant
"Nanhu"-brand model WH20-1 low-power potentiometer	Zhejiang Tong Township Radio Parts Plant

Jiangxi Province (7 items)

"Qunxing"-brand SF-826 vehicle receiver-playback	Jiangxi Gannan Radio Plant
"Jingguang"-brand FC735F metallic ceramic transmitting tube	Jingguang Electronic Tube Plant
"Sanshi"-brand SS-122 low-cost computer	State-run Jianyang Tool Plant
"Zuanshi"-brand 3DG122 NPN high-frequency low-power transistor	State-run Jiangnan Materials Plant
"Wanping"-brand CWB52-8 P2P glass padding capacitor	State-run Wanping Radio Equipment and Materials Plant

"Huadeng"-brand TR-M1404U monochrome TV set	Jiangxi Radio Plant No 81
"Jinggangshan"-brand BJ353-1 monochrome TV set	Jiangxi Television Receiver Plant

Fujian Province (7 items)

"Erling"-brand one-layer PC boards for use in monochrome TV sets	State-run Plant No 8420
"Ludao"-brand CBB61 polypropylene condensor	Xiamen Municipal Condensor Plant
"Qianjin"-brand WH124 trimming composite carbon-film potentiometer	State-run Plant No 8470
"Sanshan"-brand RT1-20 fusing transistor	Fuzhou Gulou Radio Plant No 9
"Sanfu"-brand YD100-8 electrodynamic paper-dish loudspeaker	Fuzhou Electroacoustic Equipment and Materials Plant
"Kangle"-brand LY-5 electronic acupuncture and moxibustion massage device	Fujian Xiapu Electronic Instrument Plant
"Sanling"-brand RT14 carbon-film resistor	Fuzhou Radio Parts Plant No 1

Anhui Province (5 items)

405 radar	Chang'an Machinery and Equipment Plant
"Minghua"-brand 3DG123 NPN UHF low-power transistor	Maanshan Transistor Plant
"Tongfeng"-brand CL21 metallic Dacron condensor	Tongling Radio Parts Plant No 2
"Anji"-brand AWD-3 gas alarm cut-out device	Anhui Zhunnan Radio Plant No 1
"Guanghua"-brand TS23-series coaxial attenuator	Guanghua Radio Instruments Plant

Shandong Province (6 items)

"Yaoling"-brand DJS-033 microcomputer system	Shandong Weifang Computer Company
"Langchao"-brand LC0520A microcomputer	Shandong Computer Services Company
"Haiou"-brand DCX-4 electric telemechanical microcomputer terminal equipment	Shandong Yantai Radio Plant No 6
"Qingdao"-brand $44HD_4$ monochrome TV set	Qingdao Television Receiver Plant
"Fengshou"-brand TL-4 grain hydrometer	Shandong Qingzhou Radio Plant

"Baifan"-brand SCH-2 ultrasonic thickness meter	Shandong Jining Radio Instruments Plant

Henan Province (2 items)

"Xinxing"-brand CS115 FET transistor for microphone use	Xin Township Semiconductor Plant
"Shuangshi"-brand temperature-indexed 155 polyvarnished round copper wire	Xin Township Municipal Lacquered Wire Plant

Hubei Province (5 items)

HB-502A digital computer	State-run Guangxing Machinery Plant
"Wuhan"-brand DB-33-10RD power transformer	Wuhan Radio Transformer Plant
"Qintai"-brand DB-33-2 power transformer	Wuhan Transformer Plant No 2
"WM"-brand YZD20 mag-dynamo	Hubei Huite Electric Machinery Plant
"Niaoge"-brand 145-U monochrome TV set	Wuhan Television Receiver Plant

Hunan Province (2 items)

"Jing"-brand QSG4 clear silica glass large diameter crucible	Zhuzhou Plant No 327
"Shaofeng"-brand SF35-U monochrome TV set	Hunan Television Receiver Plant

Sichuan Province (13 items)

$BT51_{a-b}$ NPN silicon planar bipolar triode	State-run Yaguang Electric Equipment Plant
3DK9 silicon switching transistor	State-run Yaguang Electric Equipment Plant
electronic tester	Ministry of Electronics, Institute No 29
DCY-972 radio jammer	Ministry of Electronics, Institute No 29
75 radiation indicator	State-run Jian'an Instruments Plant
"Xuguang"-brand Fu-113F high power ceramic transmitting tube	State-run Xuguang Electron Tube Plant
"Hongguang"-brand 13SC201R storage tube	State-run Hongguang Electron Tube Plant
"Huachang"-brand 801C electric bottle-opener and 801 EP power source	State-run Huachang Machinery Plant
"Hongming"-brand WH159WH202 synthetic membrane potentiometer	State-run Hongming Radio Equipment and Materials Plant
"Yongxing"-brand RJ14 metallic-membrane resistor	Yongxing Radio Equipment and Materials Plant
"Huawei"-brand RS101 electric razor	State-run Chongqing Miniature Electric Machinery Plant

"Shanjiang"-brand TRX(D) tinned copper wire	State-run Jiangling Electric Cable Plant
GB-01 high-efficiency air filter	Chongqing Radio Special Purpose Equipment Plant

Shaanxi Province (11 items)

model DS-3 short-wave receiver	State-run Fenghuo Machinery Plant
"Baocheng"-brand JZX-10M sealed electromagnetic relay	State-run Qunli Radio Equipment and Materials Plant
ZQM1-100/10 deuterium thyratron	State-run Baoguang Power Plant No 2
"Lingyun"-brand JD12-25[d], E series electronic warning device	State-run Lingyun Radio Plant
GZ-1-2B AM medium-wave broadcast transmitter	Shaanxi Broadcast Television Equipment Equipment Plant
CC1 wafer ceramic dielectric condensor	Huaxing Radio Equipment and Materials Plant
"Huadian"-brand TXZB-4 copper-foil covered self-extinguishing paper phenol pressboard	State-run Jinan Radio Insulation Materials
SQ27 sampling oscilloscope	State-run Hongguang Instruments Plant
"Beizi"-brand Y50250/EF250 kg mechanical vibration unit	State-run Xibei Machinery and Equipment Plant
"Jianguang"-brand 78610/ZK brush machine	State-run Jianguang Machinery and Equipment Plant
screwtap for use in M1.4~M10, JM1.4~JM10 machinery	State-run Wei He Tool Plant

Guangdong Province (2 items)

LT-1 communications equipment	Guangzhou Wire Communications Equipment Plant
"Sanhuan"-brand RD25 carbon-film resistor black matrix	Huzhou Municipal Radio Ceramic Devices Plant

Guangxi Autonomous Region (one item)

"Lijiang"-brand DGT-1/DGJ-1 color broadcast modulator/demodulator	State-run Lijiang Radio Plant

Guizhou Province (2 items)

"Xinyun"-brand CA30 liquid electrolyte tantalum condensor	State-run Xinyun Equipment and Materials Plant
"Xinyun"-brand CA solid-state electrolyte tantalum condensor	State-run Xinyun Equipment and Materials Plant

Gansu Province (2 items)

RX-207 microwave gas discharge tube	State-run Hongguang Electron Tube Plant
ML-6 radar	State-run Changfeng Machinery and Equipment Plant

Nei Monggol Autonomous Region (1 item)

"Tiane"-brand H35-3A monochrome TV set	Nei Monggol Television Receiver Plant

12586
CSO: 4008/1039

ORDNANCE INDUSTRIES' SUCCESSES IN CIVILIAN APPLICATIONS

Beijing ZHONGGUO JIXIE BAO in Chinese 1 Jan 87 p 1

[Report by Yang Qing [2799 7230]: "Output Value of Civilian Products in 1986 from the Ministry of Ordnance Industries Grows 7.9 Percent Over Last Year"]

[Text] According to statistics from relevant departments, the 1986 output value for civilian products from the Ministry of Ordnance Industries grew 7.9 percent over that of last year.

Last year, the Ministry of Ordnance Industries was at a stage of large-scale transfer from the military to the civilian, and there were very great changes in product structures. In a relatively unfamiliar production and operations environment, a large number of ordnance industry enterprises were tempered and tested. The prejudice of military industrial plants against dealing with civilian goods and the idea that they should not do so were gradually overcome, and by using the power of the military industries, they vigorously developed civilian goods. The concept of active participation in national economic construction has gradually become established.

Science research and invention in the ordnance industries have made outstanding achievements over the past year. The anti-tank missile innovative system that they developed has reached a certain level of advancement. They have also truly paid attention to efforts in transferring military technologies to civilian industries. The extended life design improvement project for diesel engines at the Shanxi Datong Diesel Engine Plant was originally used for tanks, but can now be moved over to civilian vehicles of the same model. This gives an extended useful life to diesel engines, reduces the rate of engine fuel consumption, and has been appraised by specialists to be at a relatively advanced level internationally for engines of a similar type. The ZRC520 completely automatic voltage controlled thermal shaper developed by the Beijing Red Flag Machinery Plant is the first voltage controlled unit in this country, has had breakthroughs in technology, and has recently been awarded a ministry level first prize for science and technology advancement.

12586
CSO: 4008/2060

1986 ORDNANCE INDUSTRY ACTIVITIES

Beijing ZHONGGUO JIXIE BAO in Chinese 30 Dec 86 p 1

[Text] According to some statistical data from the State Science and Technology Commission, an ordnance system unknown to the public is actually a unit which has many inventions. It ranks first among 71 ministerial commissions, provinces, municipalities and districts. During the Sixth 5-Year Plan the ordnance system won 105 national invention prizes of which 12 were second-class prizes, 53 were third-class prizes and 40 were fourth-class prizes.

At the Second National Invention Exhibition held in 1986 the ordnance system exhibited 37 projects and won 3 gold medals, 4 silver medals, and 3 bronze medals.

Most of the projects which won prizes have been put into production and have brought about obvious economic benefits. the SF-501 optical instrument anti-mildew compound which was developed by such units as the Wuxihi Optical Instrument Plant has important application value for preventing mildew on optical instruments. Of the microscopes produced by the Shanghai Optical Instruments Plant for export, 856 percent developed mildew after arriving abroad, but after using SF-501 all the goods which landed met the requirements.

The TW-1 inorganic adhesive manufacturing technology and bonding techniques which won an invention second-prize and which were developed by He Lixiang [6320 2621 03451] of the Jiangshan Machine Works of Hubei have been put into production in 28 provinces, municipalities and autonomous regions and resolved a great number of key problems in production technology, by rough estimates saving over 50 million yuan. This technological product is still selling well.

The "salt-bath furnace rapid start method" developed by Zhang Qingde [1728 1987 1795] of the Hongxing Machinery Factory in Changzhi, Shanxi, changed the traditional Chinese and foreign starting method with energysavings of 30-50 percent reducing the starting time by 60 percent. Now the Ministry of Ordnance Industry has over 400 weapons and nationally there are over 1,000 pieces of ordnance which implemented rapid starting of salt-bath furnaces saving approximately 8 million yuan in electricity.

The blank forging heating furnace and heating technology wich was developed by the Sixth Design Institute of the ministry of Ordnance Industry won a second class design prize. This is the first domestic large-scale forging induction furnace whose basic performance reaches international levels and saved over 8 million yuan in investment.

8226
CSO: 4008/2073

BRIEFS

XINJIANG 'SPARK PLAN'--The "spark plan" which was organized and carried out by Xingjiang-Uighur Autonomous Region's Science Commission and made rapid progress and good benefits, was ranked as one of 32 autonomous region level projects. Twenty-eight of the projects were implemented smoothly, 7 of which have become productive forces with annual value of production of 20 million yuan, realizing a profit of 7.5 million yuan. The "New Method of Fattening Lambs" experiment carried out by the Muleihas Muleihasake Autonomous Xian increased the weight of each lamb by 280 grams a day, and, at slaughter, live weight was 24.5 kg, with a maximum weight of 36 kg. The income for each lamb could be increased by over 10 yuan, and if extended to the 4 million lambs in the areas, an annual increase in income of 62 million yuan is predicted. The "High Density Temperature Flow Fish-rearing High Production Experiment" released luofeiyu [5012 7236 7625] into the cooling environment water of the Urumchi Hongyanchi Power Plant, and after over 140 days of cultivation, gross output was over 70 tons, with an output per mu of 4.9 tons, a gross value of production of 88 thousand yuan, and profits of 29 thousand yuan. There are three characteristics to the "spark plan" organized and implemented by Xingjiang: 1, Topic selection was precise. It stressed such conditions as preponderance of resources, expansion of markets, and range of technology satisfying both current production demands as well as conforming to long range development strategy. 2, All sides did their utmost, The Autonomous Region Science Commission wrote and translated over 7,000 volumes of educational materials, and regional, district and county science commissions trained over 13,000 rural enterprise technicians. The state, autonomous regions and relevant departments undertook responsibility as project units with a gross investment of over 23 million yuan. 3, They stressed promotion. [Text] [Beijing KEJI RIBAO in Chinese 19 Feb 87 p 2] 8226/9190

CSO: 4008/2073

GaAs HIGH SPEED PHOTOCONDUCTIVE SWITCH

Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese
Vol 8, No 1, Jan 1987 pp 99-101

[Article by Li Jinlin [2621 6930 2651], Liang Dongming [4731 2639 2494], and Zhang Jinchang [1728 6651 2490] of the Institute of Semiconductors, Chinese Academy of Sciences, paper received 7 Nov 1985; first paragraph is source-supplied abstract]

[Text] Abstract: This paper reports the use of Cr doped GaAs high resistance material for a high speed, sensitive photoconducting switch with interdigital configuration, Ni/Ge/Au metallization, and shallow etched pits to improve photo-electric coupling efficiency. Under dye laser pulsed excitation, we obtained transient responses as short as 200ps. Based on our analysis, the transient response time of this sort of photoconducting switch should be less than 100 ps, suitable for use in signal processing.

Since D. H. Auston reported that photoconducting switches had latent high speed features, there have been several advances with these switches making them components for picosecond signal detection, production, and processing in high- and low-voltage applications. These sorts of switches possess the advantages of high sensitivity, low noise, rapid responses, little wow, and high isolation for which they have received great interest from component and circuit workers.[2] Nanosecond GaAs photoconducting switches have already been reported in China.[3] This study reports on a high speed photoconducting switch. We will also discuss the material, fabrication, enclosure, and testing process to obtain this simple structured component which is capable of satisfying picosecond responses.

A high speed photoconducting switch demands a high dark current resistance, fast switching speed, and good photoelectric sensitivity. At the present stage, since Cr doped GaAs has an electrical resistance of about $2\times10^{7}\,\Omega\cdot cm$ and an electron mobility of 2000 - $3000 cm^2/V.s$, it was selected as substrate material. The Ni/Ge/Au metallization process is very mature so it was used as the micro electrode.

After cutting, grinding, and polishing, the Cr doped GaAs gets channel and electrode configuration by the conventional photo-etching alloying technology. To obtain the best photoelectric features, the evaporation

alloying technology and appropriate electrode configuration is extremely important. The evaporation alloying technology ensures the best ohmic contact and the electrode configuration provides high efficiency photocoupling for which reason we adopted interdigital electrodes. At the same time, for good photocoupling, before evaporating the metallic film, we etched an interdigital zone forming shallow etched pits acting as translucent electrodes to improve the contract area. The substrate and electrode configuration is shown in Figure 1.

The photoconducting switch was soldered on top of a common triode case base and the V_{in} and V_0 leads were soldered to the basepins. The capacitance between the two interdigitated electrodes was 10^{-14}F and the dark current resistance 20MΩ.

Measurements obtained the spectral response features of the component as shown in Figure 2 and the light intensity curve is given in Figure 3. These show that the component for 5000 - 9000A light wave lengths has fine responses with the photoconducting value and incident light power linearly related.

Switch transient state measurements of the component: The switch was excited by a beam from a tunable dye laser synchronized by a locking argon ion laser. The repetition frequency was 82MHz and the wave length 5900Å. The V_{in} passed through a 150Ω resister connected to a 1000mV direct current source and V_0 connected to the 50 impedance of a oscilloscope as in Figure 4.

The laser pulse had half widths as short as 20ps and the sample oscilloscope response times were as short as 30ps. The wave forms of the measured results are shown in Figure 5 and Figure 6 with a horizontal axis of 2ns/grid and a vertical axis of 50mV/grid.

When the average power of the laser was 11mW, the predicted pulse power was about 124pJ. The input voltage peak value was 175mV and from the following formula we computed the conducting resistance, R

$$V_0 = V_{DC} \frac{R_L}{R_s + R + R_L} .$$

in which V_{DC} was the direct current source voltage, 100mV; R_S was the internal resistance of the source, 150Ω; and R_L was the input impedance of the oscilloscope, 50Ω. Substituting the known values we get R = 86Ω. This indicates that this photoconducting switch had a high photoelectric sensitivity and rather low conducting resistance.

From Figure 6 we see that the average transient response rise and fall times was 200ps. By shortening the basepin leads as much as possible we could expect to attain a pulse with average rise and fall times of 100ps. By changing the enclosure to a coaxial form, under certain conditions one could achieve even more optimal results.

This component can be used in the different fields of photoelectric detection and the production and processing of photoelectric pulse signals to meet the ever increasing needs for picosecond measurement.

This paper received the support of colleagues of the Chinese Academy of Sciences Semiconductor Research Institute, Physics Institute and Electronics Institute and the Changchun Physics Institute. We would especially like to thank He Hongjia, Zhuang Weihua, Lin Jingu, Long Shengmin, Qi Yizhi, and Shi Xianqing. Also we would like to thank Wang Qiming, Zhou Shihe, and Ren Yuan for reading the manuscript and providing beneficial suggestions.

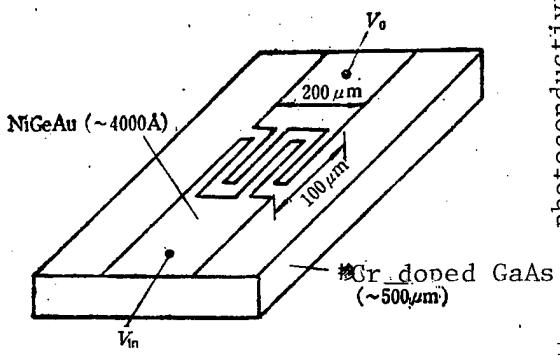


Figure 1. Photoconducting Switch

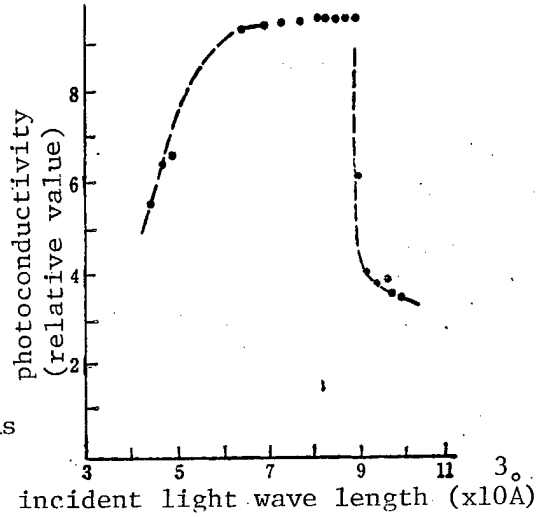


Figure 2. Photoconduction Spectral Response Curve

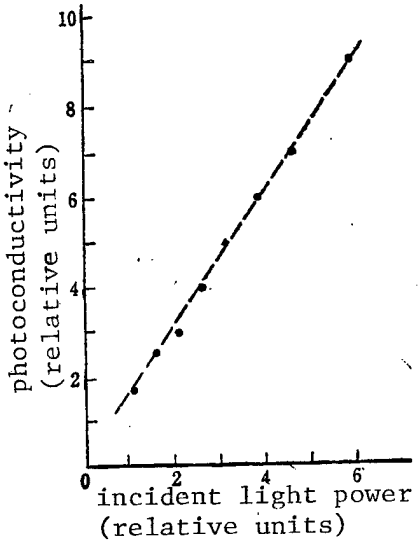


Figure 3. Photoconduction Intensity Response Curve

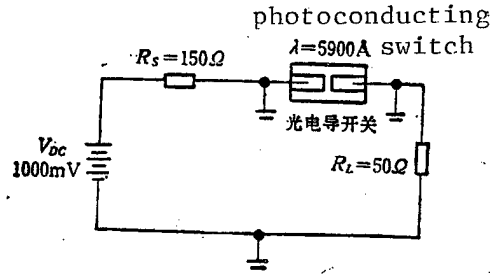


Figure 4. Transient Measurement Schematic

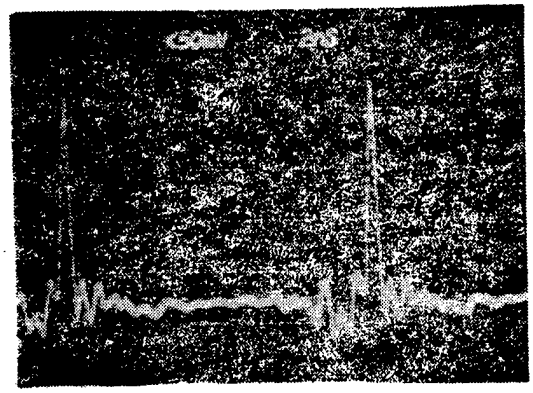


Figure 5. 82MHz Input

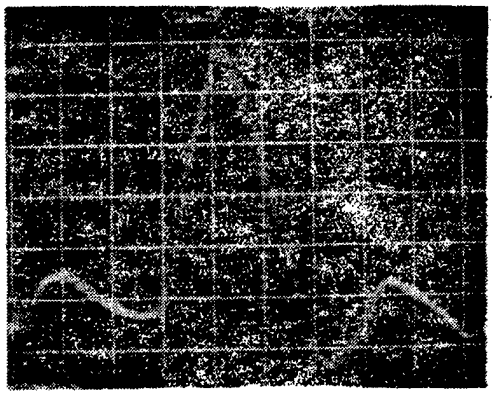


Figure 6. Fast Transient Wave Form

References

1. D. H. Auston, APPL. PHYS. LETT., 26, 101 (1975).

2. D. H. Auston and P. R. Smith, LASER FOCUS, 18, 89 (1982).

3. Zhu Xinming, Chen Lanrong, and Zhi Tingting, GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese, 3, 276 (1983).

12966/9604
CSO: 4008/1046

PHOTOLUMINESCENCE SPECTRA OF GaAs/AlAs GROWN BY MBE

Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese
Vol 8, No 1, Jan 1987 pp 90-93

[Article by Zhuang Weihua [8369 5588 5478], Teng Da [3326 6671], Xu Zhongying [1776 0112 5391], Xu Jizong [6079 4949 1350], and Chen Zonggui [7115 1350 0964] of the Institute of Semiconductors, Chinese Academy of Sciences;
paper received 21 Oct 1985; first paragraph is source-supplied abstract]

[Text] Abstract: Using domestically produced, non-doped GaAs/AlAs with a multiple quantum well (MQW) structure, a unique I line was observed in its photoluninescence spectra. The full width at half maximum, (FWHM) was 6.5 - 9meV and the emission was rather strong. The line was located between band transitions and free electron to C acceptor transitions. The peak energy moves to the higher energy end with increase of excitation energy and is linearly related to the log of the excitation energy. Its light intensity decreases with increasing temperature, vanishing at about 15K.

I. Introduction

In order to develop ultra high speed electronic components and high efficiency photoelectric components, people have done ever more sophisticated research on quantum wells and super lattice structures. Recently, studies of MBE GaAs/$Al_xGa_{x-1}As$ quantum well structure has shown that the growth temperature and hetrojunction structure has a rather strong influence on the photoluminescent efficiency of quantum wells. These phenomena are often traced to the crystal quality of $Al_xGa_{a-x}As$ and the boundary properties of GaAs/$Al_xGa_{a-x}As$. In addition the deep energy level centers (DX) in GaAs are fewer than in AlGaAs. Using GaAs/AlAs super lattice to replace AlGaAs can reduce the sustained photoconduction related to the deep centers. It is easier to get plane, step hetrojunctions in GaAs grown in two element AlAs compared to GaAs grown in three element AlGaAs. In 1984, Fujiwara and Ploog[1] used MBE GaAs/AlAs short period super lattice to replace AlGaAs to make restricting layers for the two sides of quantum wells and discovered that the SPS restricted quantum well possessed even better photoluminescence features. In view of the above perspectives we studied low temperature photoluninescence spectra of a MBE GaAs/AlAs multiple quantum well structure. In the spectra we discovered a unique spectral line, the I line. Our analysis finds that the I line is possibly related to the hetrojunction boundaries of MBE GaAs/AlAs.

II. Sample and Experimental Method

The sample structure: On a Cr admixed GaAs(100) semi-insulator substrate, first a 0.6μm pure GaAs layer was grown. Then a total of 15 periods of L_Z = 130Å GaAs and L_B = 230Å GaAs were grown. The substrate temperature, T_S = 660°C. Each layer was non-doped. The sample was N type with vestige charge carrying particles, $n \sim 1X10^{15}/cm^3$.

During the 4.2K experiments, the sample was submerged in a liquid He Dewar vessel. The exciting light source was the 5145Å line of an Ar^+ laser. Through a lens the laser excited the MQW structure and the photoluminescence signal, via a grating monochromator, was received by a cooled GaAs cathode photoelectric multiplier tube and input to a phase locking amplifier. Experiments with the temperature varied above 10K were carried out in a model CS-202 low temperature refrigerator made by the Air Products Company.

III. Experiment Results

The photoluminescence of the sample at 4.2K is shown in Figure 1. The high energy and peak of 1.544eV is the free exciton luminescence line of an n = 1 sub conduction band electron to an n = 1 sub valence band heavy hole, denoted at E_{1h}. The 1.536eV peak is a recombinative luminescence $(e\text{-}A^\circ)_i$ of an n = 1 electron to a well boundary, that is a GaAs/AlAs boundary neutral C acceptor and the 1.527eV peak is a recombinative luminescence $(e\text{-}A^\circ)_C$[2,3] of an n = 1 electron to a well center vicinity neutral C acceptor. The 1.515eV peak is a band-band (BB) luminescence of the GaAs layer (i.e. bulk GaAs material). The 1.491eV peak is a donor-acceptor pair transition luminescence line (DA) of remaining Si donors and C acceptors in the GaAs layer*.[2,3] Of note is that there is a fairly strong and broad unique spectral line, denoted as the I line, which also appears between the BB and DA peaks. The experiment showed that this I line had the following features:

1. The peak energy at 4.2K has a clear dependency on the excitation energy as shown in Figure 2. When the laser excitation intensity, P_{ex}, on sample No 27 increased about three orders of magnitude from 0.18w/cm^2 to 120w/cm^2, the I line peak energy moved from 1.4998eV to 1.5064eV. Toward the high energy direction the motion was about 7meV. At the same time the full width at half maximum, $\Delta E_{1/2}$, increased from 6.5meV to 9.3meV. Figure 3 shows the relationship between the I line peak energy, E_I(eV) and the laser intensity, P_{ex}(w/cm^2). A + sign indicates the No 27 sample results. It is evident that the I line peak energy is largely linearly related to the log of the laser intensity. Figure 3 also provides the variation of the I line peak energy with laser intensity for another GaAs/AlAs MQW sample (No 76-1, indicated by ∘).

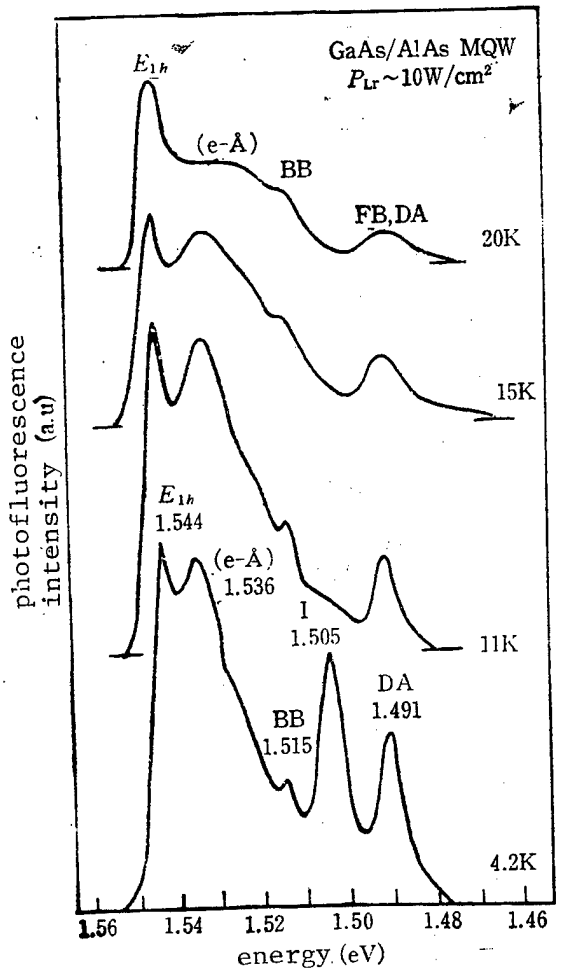


Figure 1. Variation of Luminescence with Temperature

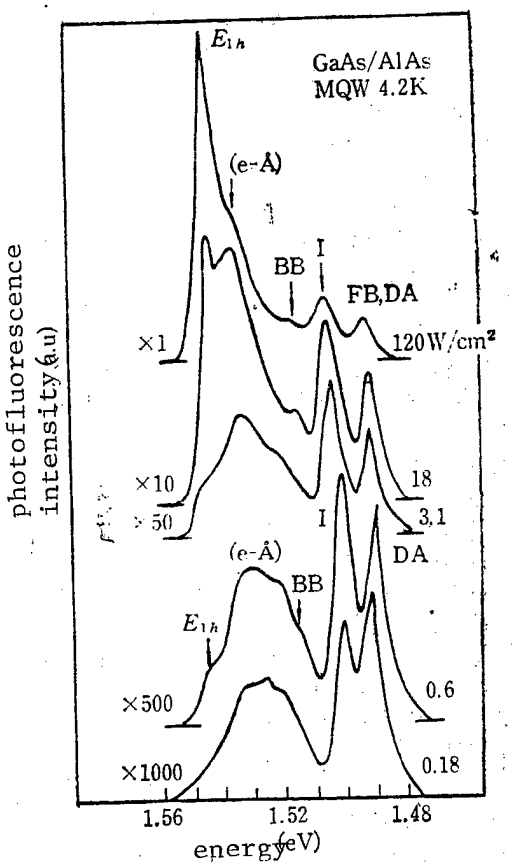


Figure 2. GaAs/AlAs MQW Luminescence Spectra for different Laser Intensities at 4.2K

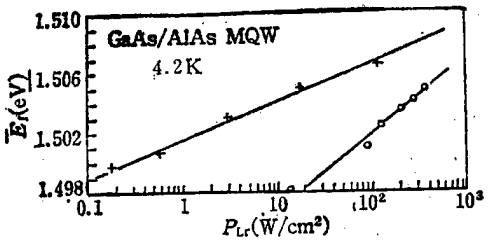


Figure 3. Relationship between I line Peak Energy and Excitation Intensity

\+ No 27, L_Z = 147Å, L_B = 225Å

∘ No. 76-1, L_Z = 83Å, L_B = 25Å

2. The I line has a rather strong dependency on temperature. Experiments varying the temperature show that as the temperature rises the I line quickly falls. As shown in Figure 1, at 11K the I line already has become a shoulder peak and at 15K and above the line completely vanishes. Opposite to the I line in the figure, in the region of 4.2 to 20K, the BB peak and the FB transition peak of free electrons to acceptors, in both intensity and energy position do not exhibit very big changes.

From Figure 2 we can also see that when P_{ex} increases, the spectral lines E_{1h} and (e-A°) related to the quantum wells rapidly strengthen. This explains the very strong capturing action of the quantum well structure with respect to photo carriers. A large quantity of charge carriers sink into potential wells and the energy level raditation through the wells recombines possessing very high efficiency. At low excitation power, the DA related to residual impurities in the GaAs layer is strongest with respect to luminescence. When P_{ex} increases, the velocities of the I line and the BB line are faster than the DA line. Moreover the light intensity of the I line exceeds that of the DA line. This explains why there is a close relationship between the production of the I line and the free charge carriers between bands.

IV. Discussion of Results

We believe that the I line observed in this experiment and bound exciton (d.x) peaks caused by defects in the MBE GaAs are not the same. It is true that the luminescence energy of the I line is close to the (d.x) peak (1.504 - 1.511eV). However, because the (d.x) peak is caused by a fixed number of defect centers when the excitation energy strengthens, the (d.x) luminescence intensity has a tendency to saturate. In addition the movements of the position of (d.x) peaks with variation in P_{ex} are very few. Yet the luminescence intensity of the I line we observed showed no clear saturation phenomena. At the same time, the position of the peak value clearly moved to the high energy end with excitation intensity increases. Evidently there are clear distinctions in the features of the I line and the (d.x) line. Further, from the view point of spectral energy and spectral line width, the I line also could not be luminescence caused by deep energy levels in the GaAs or AlAs. Besides the fact that the I line luminescence and the deep energy level luminescence energies are not the same, in general deep energy level emission lines are all quite broad with full width at half maximum reaching about 150meV while the full width at half maximum of the I line is only 6.5 - 9MeV. From the above facts we know that the I line certainly does not come from GaAs defect or impurity optical emission, nor does it originate in AlAs layer defect or impurity luminescence.

Yuan Yourong et al. have observed an H line related to hetrojunction boundaries in lightly or non-doped LPE GaAs/Al GaAs hetrojunctions.[4,5] Photofluorescence experiments with step etched samples proved that the H line came from the boundary of GaAs/Al GaAs hetrojunctions. They also used the limiting action of quasi-triangular potential wells present at the hetrojunctions with respect to the charge carriers to explain production and variation of the H line luminescence phenomena. Several features of

the I line we saw in the MBE GaAs/AlAs MQW structure are similar to those of the H line.

With regard to the GaAs/AlAs hetrojunction boundary, because the forbidden band widths and electron affinities of the two materials are different, at the boundary, there can form quasi-triangular potential wells. A portion of the nonequilibrated charge carriers put out by the laser excitation will fall into these potential wells. Because the depth of the potential well is limited, the charge carriers bound in the potential well can, via the tunnel effect, penetrate into the center of the forbidden band recombining with valence holes causing radiation of recombined luminescence. This is equivalent to a diagonal transition between full andempty energy bands. The emitted energy of this is lower than a BB transition between bands. When the excitation intensity is increased, due to the charge shielding effect and the charge carrier packing effect it makes the luminescence line clearly move toward the high energy end. A similar luminescence peak has also been observed in nipi structures.[6] Of course, there are multiple hetrojunction boundaries present in the GaAs/AlAs MQW structure and exciton dimension effects due to the GaAs well layer being narrow. The explanation of this will be rather complex and awaits further analytical work.

V. Conclusion

Summarizing the above, in the photofluorescent spectrum of a non-doped MBE GaAs/AlAs MQW structure a unique spectral line, the I line, was observed. It is a line with a 6.5 - 9meV full width at half maximum and rather strong luminescence. It was positioned between the bulk GaAs band-band transition BB line and the free electron to acceptor transition FB line. When the excitation energy was increased the luminescence peak value moved toward the high energy end. The peak value energy and the log of the excitation energy displayed a linear dependency relation. The luminescence intensity was reduced with increasing temperature and vanished at about 15K. In view of these facts the I line is very likely related to hetrojunction boundaries in GaAs/AlAs.

The authors are grateful for the support of Professors Xie Huangkun, Wang Shouwu, Lin Lanying, Xu Zhenjai, and Wang Qiming. The authors also want to express their appreciation to the following colleagues, all of the Institute of Semiconductors Particle Beam extension group, Kong Meiying, Sun Dianzhao, Liang Jiben, and Huang Yunheng for help with the sample and to Wu Lingxi and Zhang Zehua for assistance with mensuration.

References

1. K. Fujiwara and K. Ploog, APPL. PHYS. LETT., 45, 1222 (1984).

2. Xu Zhongying, Xu Jizong, Li Yuzhang, Deng Baozhen, Xu Junying, Zhuang Weihua, and Chen Zonggui, BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese, 7, 319 (1986).

3. Z. Y. Xu, Z. G. Chen, D. Teng, W. H. Zhuang, J. Y. Xu, J. Z. Xu, B. Z. Zhen, J. B. Liang, and M. Y. Kong, "The Second International Conference on Modulated Semiconductor Structures," p 174.

4. Yuan Yourong and J. L. Merz, FAGUANG YU XIANSHI [LUMINESCENCE AND DISPLAY] in Chinese, 5, No 3, 33 (1984).

5. Y. R. Yuan, K. Mohammed, M. A. A. Pudensi, and J. L. Merz, APPL. PHYS. LETT., 45, 739 (1984).

6. K. Ploog and G. Dohler, "Adv. in Phys.," 32, 285 (1983).

12966/9604
CSO: 4008/1046

PREPARATION, PROPERTIES OF a-Si:H/a-SiN$_x$:H SUPERLATTICE FILMS

Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese
No1 8, No 1, Jan 1987 pp 94-98

[Article by Wang Zhichao [3769 1807 6389], Liu Xiangna [0491 3276 1226], He Yuliang [0149 1342 0081], and Wu Rulin [0702 3067 7792] of the Department of Physics, Nanjing University, paper received 16 Nov 1985; first paragraph is source-supplied abstract]

[Text] Abstract: This paper reports on the method of preparation, structure, and optical aspects of the quantum dimension effects of a-Si:H/a-SiN$_x$:H super lattice films.

Introduction

With the rapid development of science and technology, people have been making ever higher demands on the properties of semiconductor materials. Already the simple pursuit of crystal perfection in semiconductor materials cannot satisfy these demands. In the seventies people broke through old conceptions and used two kinds of semiconductor films alternately grown together with similar crystal structure and different forbidden band widths to construct a new semiconductor multilayer material. These so-called monocrystal semiconductor super lattice films had an excellent behavior not present in block monocrystal semiconductors and could be used to construct high performance semiconductor components. However the construction of monocrystal semiconductor super lattice films needs high-level crystal growing techniques and demands lattice matching between the layers in the film and the substrate material. Due to these factors, the difficulty of constructing monocrystal semiconductor super lattice films is greater. In 1983, there was a foreign report of the use of a plasma chemical vapor deposition (PCVD) apparatus to make noncrystalline semiconductor super lattice films. These films still had quantum dimension effects and a physical behavior similar to monocrystal semiconductor super lattice films. The demands on the film layers and substrate material to make noncrystalline semiconductor super lattice films were not that severe. Also, application of a PCVD apparatus was simple and low cost and consequently was particularly noticed. Two years later, in June 1985, we successfully used our self designed single chamber PCVD apparatus to make noncrystalline semiconductor super lattice

films. Below we introduce the method of preparation, structure, and optical aspects of the quantum dimension effects of a-Si:H/a-SiN_x:H super lattice films.

II. a-Si:H/a-SiN_x:H Super Lattice Film Preparation

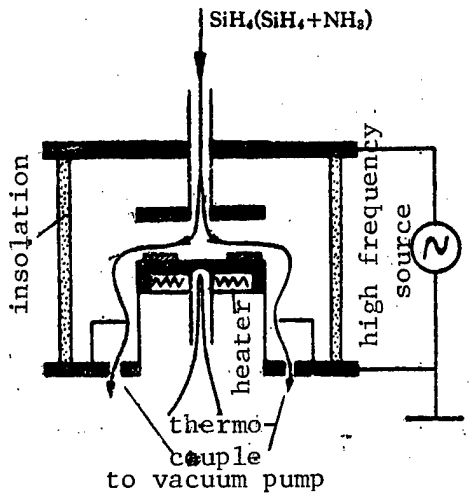


Figure 1. PCVD Apparatus

We used a self-designed single chamber PCVD apparatus (see Figure 1) to make a-Si:H/a-SiN_x:H super lattice films. A substrate plate which had undergone cleaning treatment was placed in the reaction chamber. Using a vacuum pump the reaction chamber was evacuated conscientiously then filled with hydrogen. Through about 5 minutes of high frequency discharge the corrosive action of hydrogen plasma was used to carry out a cleaning treatment of the substrate surface. Then SiH_4 mixed with NH_4 gas were separately introduced. Via high frequency discharges, a-Si:H and a-SiN_x:H films were alternately deposited on the substrate surface and, based on prior design requirements, the desired a-Si:H/a-SiN_x:H noncrystalline semiconductor super lattice film was prepared. In order to obtain a high quality super lattice film, the following points must be noted in the preparation process:

1. Note the components of the raw material gas.

The components of the SiH_4 gas and SiH_4 with NH_3 mixed gas must be precise and while changing the gas components interaction between them must be reduced as much as possible. In the experimental process, the SiH_4 gas flow was maintained unchanged. Based on opening and closing the NH_3 valve we changed the gas composition in the reaction chamber. When opened or closed the reaction chamber discharge was stopped and begun again only after the gas composition in the chamber had stabilized. This way sudden hetrojunctions could be obtained in the super lattice films prepared.

2. Strictly control the thickness of each layer.

The properties of noncrystalline semiconductor super lattice films are closely related to the thickness of each of their layers. If one cannot control the thickness of each layer based on prior design requirements, then the noncrystalline semiconductor super lattice films made will not display the desired properties.

3. Note the effect of the substrate surface on the deposited film.

Since the individual layers in a super lattice film are very thin, with thicknesses of a few to several tens of Angstroms, unevenness of the substrate can severely damage the homogeneity and integrity of a film layer. This effect is particularly large in those layers close to the substrate. Consequently one must strive for the substrate to be plane and smooth. In addition, it should also be noted that when deposited on glass and other substrates, the Si atom exhibits island shaped growth, the so-called Volmeer-Weber type growth, so that when the deposited film is very thin, it will often be discontinuous and display a network structure. Therefore, prior to deposit, suitable treatment must be carried out on the substrate surface to enhance the infiltration between the deposited film and the substrate surface. At the same time the thickness of the required individual layers cannot be excessively small. This way one is better able to attain continuity. However, the best way is to search out a material that makes a-Si:H and a-SiN_x:H exhibit graded growth on its surface, that is the so-called Frank-van der Merwe type growth. This way, even if the a-Si:H/a-SiN_x:H individual layers of the super lattice film are extremely thin their homogeneity and integrity can be ensured.

III. Structure of a-Si:H/a-SiN_x:H Super Lattice Films

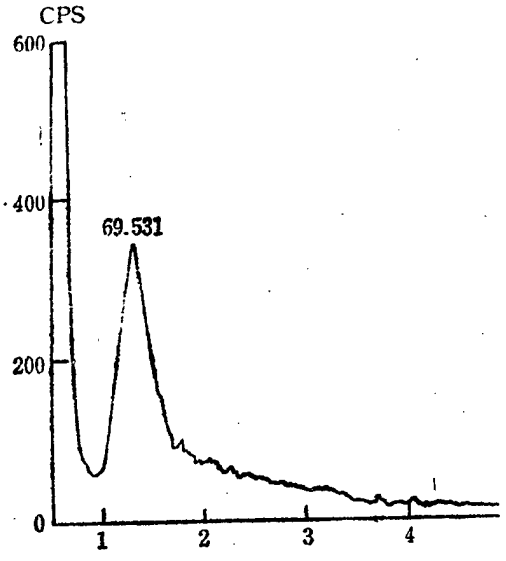


Figure 2. a-Si:H/a-SiN_x:H Super Lattice Film X-ray (wave length 1.54Å) Diffraction Diagram

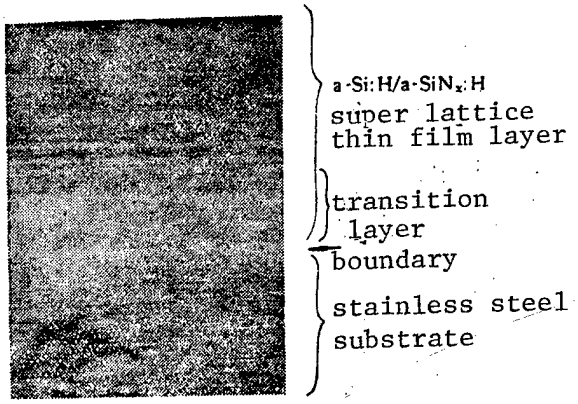


Figure 3. Complex Photograph of a-Si:H/a-SiN_x:H Super Lattice Film (X 100K)

After making a-Si:H/a-SiN_x:H super lattice films, we verified that the samples had a periodic structure through small angle X-ray diffraction and TEM observations as shown in Figure 2 and Figure 3. In Figure 2, based on first order Bragg diffraction peak values, we applied the formula 2dsinq=kl finding that the average thickness of each layer in the super lattice film was 35Å. This was very close to the prior estimated thickness based on growth rates.

In order to observe the internal periodic structure of a-Si:H/a-SiN_x:H super lattice film more directly, we used TEM to carry out observations of its cross section. The process we used was as follows: First we cut the sample which was then finely ground and polished. Then the plasma corrosion technique was used to corrode the cross section. Because the F atoms of the nascent state in the plasma are much faster with respect to the corrosion speed of a-SiN_x:H than of a-Si:H, the result after corrosion is to form line after line of channel traces on the cross section. Via compelxing with respect to the cross section and using TEM to carry out observations, we get photographs as shown in Figure 3. Because the individual layers in super lattice films are very thin, during complexing the metalizing particles of platinum and carbon cannot be very fine so the images obtained are quite fuzzy. However, we can still see that the cross section of a-Si:H/a-SiN_x:H super lattice film has a periodic, layered structure. In using TEM to observe super lattice structures, generally the sample is cut into a thin slice along the cross sectional direction --> grinding and polishing --> ionic thinning --> finally carrying out observation using TEM. The techniques of this process are rather complicated and the difficulties great. While using our method is much simpler, the layer thickness is not easily controlled.

IV. Results and Discussion

In super lattice structures, when the width of potential well layers and the de Broglie wave lengths are about the same, some of the energy levels occupied by current carriers in the potential wells will clearly fragment forming many energy sublevels. The result is equivalent to increasing the forbidden band width and produces the so-called quantum effect as shown in Figure 4.[1] In the experiment, we used three samples with total width of approximately the same (about 5000Å), different structures, and glass as substrate. These were an a-Si:H(37Å)/a-SiN_x:H(43Å) multilayer film sample, an a-Si:H(160Å)/a-SiN_x:H(220Å) multilayer film sample, and an a-Si:H single layer film sample. Doing optical measurements we examined the relationship between optical absorption lines and sample structure. The measured results are indicated respectively by the three curves A, B, and C in Figure 5. To facilitate comparison, these three curves are drawn together as shown by D in Figure 5. From D we can clearly see that although sample B was a multilayered film, because the period of its structure was larger (160A + 220A), its absorption line spectra is nearly a complete repeat of that for C. This explains why the performance of it and the single layer film are similar to each other and do not have quantum effects. With the A sample, because the structural period is smaller, the electrons and holes in the potential wells are quantitized so the result is equvalent to

increasing the forbidden band width of the potential well layer. Thus, comparing the A spectral lines with those of B and C in D reveals that the A line optical absorption boundary is clearly shifted to the left about 30nm. If we look at it from the numerical value of the optical forbidden band width, E_g^{opt} for the three samples, the numerical values of the B and C samples are approximately equal with E_g^{opt} = 1.83eV and the numerical value of the A sample is E_g^{opt} = 2.03 eV which shows that in the A sample, due to the production of quantum dimension effects, its optical forbidden band is increased 0.20eV compared to that of B and C. This phenomena and the contents of those reported abroad are identical.[1,2,3] From this we know that the A sample is a noncrystalline semiconductor super lattice film with clear quantum dimension effects.

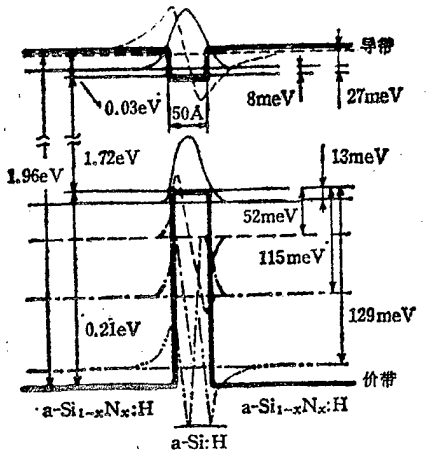


Figure 4. Energy Band Diagram in a-Si:H(50A)/a-SiN_x:H(x = 0.2) and Quantitized Energy Levels

Throughout this work we obtained the energetic assistance of Zhou Hengnan of Nanjing University Physics Department, Qiu Dirong, Jiang Shangen, Zhu Jie. Wang Huaqin, and Chen Guanghui of Nanjing University's Contemporary Analysis Center, Li Shuqiu of Nanjing's Soil Research Institute, and Yang Xiaoxi of Nanjing's Electro-Optical Source Materials Research Institute. We wish to express here our heartfelt gratitude to all these individuals!

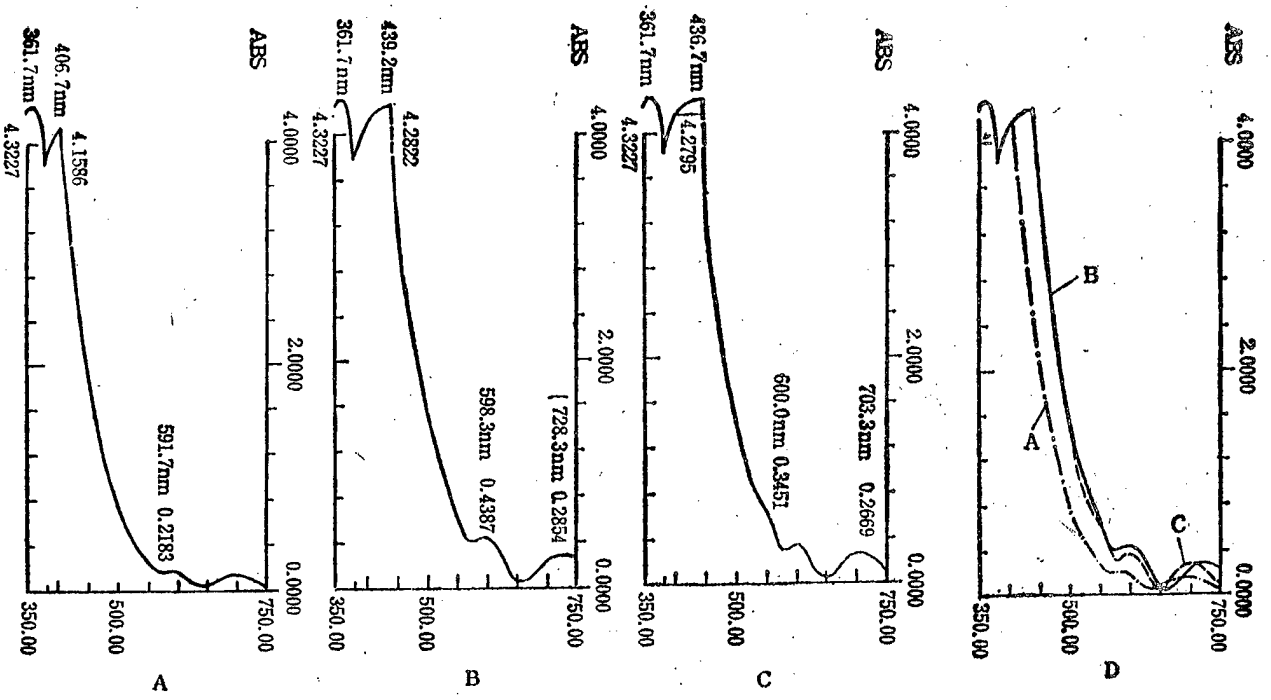


Figure 5. Photo-absorption Spectral Lines for Different Samples

References

1. Seiichi Miyazaki and Zenko Hirase, KOTAI BURITSU [SOLID STATE PHYSICS] in Japanese, 19, 541 (1984).

2. B. Abeles and T. Tiedje, PHYS. REV. LETTER, 51, 2003 (1983).

3. J. Kakalios, H. Fritzsche, "17th International Conference on the Physics of Semiconductors," p. 81, (1984).

12966/9604
CSO: 4008.1046

- END -